

NUCLEAR SCIENCE ABSTRACTS

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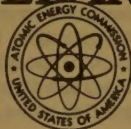
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NUCLEAR SCIENCE ABSTRACTS



Volume 13 Number 14

July 31, 1959

GENERAL

12327 ARGMA-TN-1C20N-1

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

RESEARCH LABORATORY QUARTERLY RESEARCH REVIEW NO. 20 [COVERING PERIOD] NOVEMBER 1, 1958 - JANUARY 31, 1959. Mar. 1, 1959. 96p.

Plexiglas with centrally located circular holes was fractured by transmitting the load through a pin placed in the hole. The configuration of the plates is described and dimensions are given. Results of static and high-speed tests are presented. Investigations with the Van de Graaff accelerator are reported, the positive ions of most interest being protons and deuterons and target materials being Be, deuterium, and tritium. Partial cross sections are discussed, and the equation for the (n,p) cross section is presented. In nuclear spectroscopy the polarization sequence $\frac{3}{2}(E2) \frac{1}{2}(E2 + M1) \frac{5}{2}$ where either the polarization of a 496-kev or 122-kev gamma ray could be measured is examined, and data are presented. The magnetic properties of thin films were investigated using a new technique to place films on Cu mesh specimen grids. With these films as a substrate Fe specimens were prepared and examined in the electron microscope. A method for mounting substrates for use in the electron microscope is described. Electrical properties of argon plasma were determined by application of small d-c voltages across the probes of a double Wilson probe which are then passed as a unit through the electrically conducting plasma. Results are presented graphically. Progress is reported in low-temperature production of NF_3 . The effects of oscillations on heat transfer at Reynolds numbers up to about 37,000 were investigated, and results are tabulated and graphed. Asymmetrical aging in space travel is considered, and a problem solution is presented. (J.R.D.)

12328 BNL-526

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] JULY 1 - SEPTEMBER 30, 1958. Feb. 1959. 39p. \$1.25(OTS).

The unclassified research progress of the Laboratory is summarized in physics, Cosmotron, chemistry, reactors, instrumentation, health physics, biology, and medicine. Abstracts are given for research activities currently being reported in the scientific journals. (For preceding period see BNL-515.) (W.D.M.)

12329 RM-2270(RAND)

RAND Corp., Santa Monica, Calif.

THE RESPONSE OF HYPOTHETICAL MISSILE TRANS-

PORT EQUIPMENT TO NUCLEAR BLAST. W. R. Elswick. Oct. 16, 1958. 18p. (AD-205871).

An attempt is made to analyze the loading and response of a structure when subjected to overturning by the blast of an atomic explosion, and to present some results for mobile equipment which may be typical of mobile ballistic missile equipment. The study assumes that the structure is rigid and free to rotate about the fixed downwind wheel line, that the drag coefficient and drag area are constant, and that the diffraction load rises abruptly with the arrival of the shock front and decays linearly to zero in the time required for the shock front to traverse a distance equal to one and one-half times the vehicle height. (auth)

12330 WT-1713

Waterways Experiment Station, Vicksburg, Miss.

GROUTING CONSULTING SERVICE. James M. Polatty, Ralph A. Bendinelli, Melvin Glass, and Bill J. Houston. Dec. 1958. 21p. Project 26.12 [of] OPERATION HARDTACK, PHASE II. \$0.75(OTS).

The drilling and grouting operations conducted in connection with the underground nuclear detonations of Operation Hardtack, Phase II, are described in detail. The composition of the four grouting mixtures used is given. Also, hourly time logs are included as tables of the drilling of the four holes. (auth)

12331 CEA-tr-A-378

LA RADIOACTIVITÉ DE L'AIR ET LA DIRECTION DU VENT. (Air Radioactivity and the Wind Direction.) E. Bagge. Translated into French from *Atomkernenergie* 1, 393-6(1956). 13p.

Preliminary results made on the radioactivity of the air measured in Hamburg in 1956 are reported. The average activity found from May 4 to June 23, measured at a height of 24 m, was 0.992 mr/day; from July 13 to September 22 the measurements made at a height of 60 m showed an average activity of 0.650 mr/day. The measurements show considerable daily variations in the amount of radioactivity. It was clearly established that the radioactivity was closely connected to the dominant wind direction. When the wind is from the east, the dominant direction, the values are high. When the wind is from the west, the smallest values are obtained. (J.S.R.)

12332 CEA-tr-I-26

CARACTÉRISTIQUES DE L'ARCHITECTURE ET DE LA CONSTRUCTION DES INSTALLATIONS NUCLÉAIRES. (Characteristics of the Architecture and the Construction of Nuclear Installations.) J[ohn] Cockroft. Translated into French from *Energia nucleare* (Milan) 5, 417-25(1958). 21p.

The characteristics of the architecture and construction of nuclear installations are reviewed by a survey of the specifications used in the building of various British nuclear installations. (J.S.R.)

12333

ON THE ECONOMICS OF NUCLEAR POWER. E. P. Anan'ev. *Atomnaya Energ.* 6, 245-52(1959) Mar. (In Russian)

A review is given of the economics of nuclear power, based on data presented at the Second Geneva Conference. The initial construction costs, plants, the operation factors, and their effects on the nuclear power plant economics are analyzed. The economic problems of atomic power plants with fast reactors are also discussed. (tr-auth)

12334

MAXIMUM LEVEL CONTROL AND REGULATION WITH RADIOACTIVE ISOTOPES. A. Trost. *Atompraxis* 5, 59-66(1959) Feb. (In German)

The weakening of gamma and beta rays in container contents is used for measuring content levels, for monitoring maximum levels, and for giving a continuous reading and regulation of content levels. Technically tested procedures, arrangements, and equipment are described, and the performances and limitations of these methods are given. Questions of radiation protection are discussed. (auth)

12335

IONOSPHERIC DISTURBANCES WITH A SHARP BEGINNING CAUSED BY AN ATOMIC EXPLOSION. Atsushi Kimpara (Univ. of Nagoya, Japan). *Compt. rend.* 248, 2117-19(1959) Apr. 6. (In French)

During a nuclear explosion at high altitudes, the meteorological circumstances permitted an observation of atmospheric re-enforcements caused by an ionospheric disturbance with a sharp beginning. The observations were made August 12, 1958, at 10, 21, and 27 kc/sec. (tr-auth)

12336

A RELATIONSHIP OF INDETERMINACY APPEARS TO RULE THE INSURING OF NUCLEAR RISKS. Théodore C. Pontzen. *Inds. atomiques* 3, No. 1-2, 92-6(1959). (In French)

The uncertainties involved in the insuring of nuclear risks are discussed. These include third party responsibility, the possible wide consequences of nuclear accidents, the time interval apt to elapse between exposure and effects, and the lack of uniformity in the national laws governing the use of radioactive materials and the safety features to be employed. (J.S.R.)

12337

REPORT OF A THREE-MONTH STUDY PERIOD IN JAPAN BY GERMAN HEALTH PHYSICISTS. Rudolf Wittenzellner (Univ. of Munich). *Strahlentherapie* 108, 585-93(1959) Apr. (In German)

The organizational part of an educational trip to Japan of 3 months duration is discussed, including visits of Japanese universities, clinics, and medical and research institutions. (auth)

12338

IMPROVEMENTS IN AND RELATING TO SEALS. Bernard William Bradford and Wilfred Jesse Skinner (to United Kingdom Atomic Energy Authority). British Patent 809,281. Feb. 18, 1959.

The preparation of graphite seals for rubbing use in UF₆ vapors is described. The graphitic carbon is treated with UF₆ vapor and mixed with polytetrafluor-

ethylene. The mixture is pressed in molds at 2.5T and heat treated to 400°C for 3 to 4 hours. (T.R.H.)

12339

APPARATUS FOR CYCLICALLY MONITORING POTENTIALS AT A NUMBER OF STATIONS. Dennis Dawes Bowen (to United Kingdom Atomic Energy Authority). British Patent 811,111. Apr. 2, 1959.

An electronic device is described which cyclically measures the potentials from a number of points, compares them with a specified value or range and records the time, value, and direction of variation of a potential from the specified value or range. (T.R.H.)

12340

IMPROVEMENTS IN OR RELATING TO THE SEPARATION OF GASEOUS MIXTURES. Schofield Labrow, James Findlay Dunn, Robert Lipscomb, and Andrew Craig (to United Kingdom Atomic Energy Authority). British Patent 811,930. Apr. 15, 1959.

A device for separating gases by differential freezing is described. Gas is introduced at the bottom of a cooled container, and a part of it freezes out on the walls to be scraped off by an oscillating scraper. The unfrozen portion passes out the top. An arrangement at the bottom allows reheating and removal of the scraped-off portion without losing pressurization of the container. This arrangement consists of a series of openings in a plate coupled to the oscillating scraper. (T.R.H.)

BIOLOGY AND MEDICINE

12341 AECU-3892

Los Alamos Scientific Lab., N. Mex.

THE EFFECTS OF LETHAL DOSES OF X RAYS ON THE MATURATION OF THE RAT OVUM AND ITS MODIFICATION BY GONADOTROPINS. J. F. Spalding, J. M. Wellnitz, and W. H. Schweitzer. [1955]. 17p. Contract [W-7405-eng-36]. \$3.30(ph), \$2.40(mf) OTS.

Three groups of mature female rats were exposed to 750, 1500, or 3000 r of x rays, respectively, to the whole body. One group was treated with gonadotropic hormones following x ray exposure and the second group was untreated. Ovarian and tubal ova from both groups were studied as whole mounts and paraffin sections. No ovum damage was observed at 2 to 4 hours after x ray exposure of 750 r, but some atresia was evident in all animals exposed to 1500 or 3000 r at this time. Post-exposure injections of gonadotropic hormones did not produce ovulation, but did stimulate ovum maturation even when the ovary was in an advanced stage of degeneration. Primitive ova and ova in secondary follicles were the first stages of germ cell development to show general degenerative changes following x ray exposure. Interphase ova in primary follicles were relatively radioresistant, and in many cases appeared normal until the animal died from x ray exposure. (auth)

12342 AECU-4101

Bjorksten Research Foundation, Madison, Wis. FUNDAMENTALS IN AGING—INSOLUBILIZATION OF PROTEIN AS A FUNCTION OF AGING. Final Report. Johan Bjorksten, Fred A. Andrews, Bruce Trenk, and Julia Bailey. Mar. 31, 1959. 36p. Contract AT(11-1)-606. \$6.30(ph), \$3.00(mf) OTS.

Whole-body x irradiation was used to accelerate the onset of senescence in female white rats. Comparisons of nonirradiated and irradiated tissues have been made

using histological, physical, and enzyme techniques. The data amassed to date indicate that x irradiation causes a reduction of 20.6 percent in alpha-amino nitrogen liberated by tryptic hydrolysis in liver homogenates. This reduction in amino nitrogen is not observed, however, in muscle homogenates. Shrinkage temperature determinations indicate that irradiation may result in cross-linking of rat tail tendons in a manner resembling nonirradiated mature tendons. It is felt, however, that irradiation has also severed peptide bonds in the collagen which complicate interpretation of the data. It is postulated that this observation may be useful both for a study of collagen structure and also as a clinical method for determining the extent of irradiation absorbed accidentally. (auth)

12343 MLM-1062

Mound Lab., Miamisburg, Ohio.

THE EFFECTS OF SMALL AMOUNTS OF POLONIUM ON RATS. R. K. Davis, G. T. Stevenson, K. A. Busch, and D. S. Anthony. Aug. 1955. 25p. Contract AT-33-1-GEN-53. \$0.75(OTS).

Large groups of Sprague-Dawley rats were given either small single intravenous injections of 0.75, 0.5, or 0.25 microcurie of Po^{210} per kilogram body weight; or repeated doses designed to maintain a relatively constant polonium burden of 0.01 microcurie per kilogram body weight. Since the most sensitive criteria of polonium damage had been shown to be shortening of life span, or possibly increased tumor incidence, these two possible effects were given the most attention in observations continuing throughout the adult life of the animals. Definite shortening of life span occurred in male rats that had received the single doses of 0.75 or 0.5 microcurie per kilogram body weight. Life span shortening at the 0.25 microcurie level was not as definite, though probable. None of the groups of females receiving single doses showed significant life span shortening, possibly in part because of the greater variance of the female populations. A maintained polonium burden of 0.01 microcurie per kilogram body weight was completely without measurable effect. No effect on tumor incidence was observed in any of the single or multiple dose groups. However, the tumor incidence in all groups of old injected and control rats was very high. (auth)

12344 NP-7480

California. Univ., Los Angeles.

EFFECT OF IONIZING RADIATION ON THE NUTRITIVE AND SAFETY CHARACTERISTICS OF FOOD. Progress Report [for] period September 15, 1958 - March 15, 1959. J. F. Mead and W. H. Griffith. Mar. 15, 1959. 23p. Contract DA-49-007-MD-579.

The feeding of irradiated bacon and fruit compote to rats has passed the 101st and 87th week for the two replicates. A statistically significant difference due to the 3x fruit is apparent in the growth of the 3rd generation females of replicate II. The lipids extracted from the brains of young, middle age, and old rats have been separated into a cholesterol and a phospholipid fraction. There is no difference between the old animals on control or irradiated food, but brains from weanlings contain more phospholipid and less cholesterol than do brains from rats 36 weeks old or older. (auth)

12345 NP-7484

Vanderbilt Univ., Nashville. School of Medicine.

LONG-TERM MONKEY FEEDING EXPERIMENT ON IRRADIATED PEACHES, WHOLE ORANGES AND PEELED ORANGES. Progress Report No. 4-B [for] period

October 12, 1958 to March 29, 1959. Frank R. Blood, William J. Darby, Richard C. Dybdahl, Carl E. Miller, Charles W. Scheffer, Jon M. Buhler, and Matthew Wright. 23p. Contract DA-49-007-MD-779.

Rhesus monkeys were maintained for 60 weeks on a diet containing peaches irradiated at zero, 2.79, and 5.58 megarads, and whole and peeled oranges irradiated at zero, 0.15, and 0.30 megareps. Eosinophilia was evident at first but subsided and all hematologic values were normal for the period of this report. No effects due to the toxicity of the irradiated foods were noted. (auth)

12346 NP-7485

Vanderbilt Univ., Nashville. School of Medicine.

LONG-TERM RAT FEEDING EXPERIMENT ON IRRADIATED BEEF. Progress Report No. 3-C [for] period September 3, 1958 to March 31, 1959. Frank R. Blood, William J. Darby, Richard C. Dybdahl, Cornelius F. Kalman, Carl E. Miller, Jon M. Buhler, Charles W. Scheffer, Matthew Wright, and Russell West. 24p. Contract DA-49-007-MD-779.

Ground beef irradiated at zero, 2.79, and 5.58 megarads was fed to three replicates of 54 rats each. Weight gains were uniform on the three levels of diet. Hematologic values remained normal, and no hemorrhagic disease was observed. Eight male and three female rats expired due to respiratory disease or tumors. No effects related to the toxicity of the irradiated beef were noted. (auth)

12347 NP-7486

Saint Louis Univ. School of Medicine.

HEMORRHAGIC SYNDROME IN RATS FED IRRADIATED BEEF. Progress Report No. 1 [for] period September 1, 1958 to April 1, 1959. E. A. Doisy, Jr. and J. T. Matschiner. 12p. Contract DA-49-007-MD-996.

Preliminary data are presented on weight changes and prothrombin times in rats maintained for 10 to 12 weeks on a diet containing fresh or irradiated beef. Of 22 animals fed a diet containing irradiated beef, only one animal displayed any internal bleeding and that was a minor hemorrhage of the epididymis. (C.H.)

12348 NP-7487

Oregon. Agricultural Experiment Station, Corvallis.

THE GROWTH, BREEDING, LONGEVITY AND HISTOPATHOLOGY OF RATS FED IRRADIATED OR CONTROL FOODS (TISSUE ENZYME STUDIES). First Semi-Annual Progress Report [for] September 15, 1958 - March 15, 1959. Ian J. Tinsley and Edward C. Bubl. Apr. 1, 1957. 9p. Contract DA-49-007-MD-580.

Female rats raised on rations containing irradiated pork showed a higher cytochrome oxidase activity in liver and kidney homogenates than that observed in animals raised on the control ration. Using liver mitochondrial preparations, an increase in DNP stimulated ATP-ase as well as an increase in cytochrome oxidase was observed in the animals fed the ration containing irradiated pork. It was suggested that these effects could be associated with the vitamin K status of the animal. No changes were observed in P/O ratios which could be attributed to the ration. Animals fed rations containing irradiated jam showed a decreased rate of fructose oxidation as well as a lower rate of endogenous oxidation in heart homogenates when compared with the animals fed control ration. (auth)

12349 NP-7490

Hazelton Labs., Falls Church, Va.

LONG-TERM FEEDING STUDIES ON IRRADIATED

CORN AND TUNA FISH. Progress Report No. 5 [for] September 12, 1958 to March 9, 1959. O. E. Paynter. 3p. Contract DA-49-007-MD-788.

No significant changes were observed in body weight gains, food consumption, general physical condition, behavior, or survival of rats maintained for 77 weeks on a diet containing irradiated corn and tuna fish. (C.H.)

12350 NP-7497

Medical Coll. of Virginia, Richmond.

MECHANISM OF THE HEMORRHAGIC PHENOMENON PRODUCED IN MALE RATS BY FEEDING OF IRRADIATED BEEF. Progress Report No. 2 [for] period September 15, 1958 to March 15, 1959. Susan J. Mellette and Louis A. Leone. 23p. Contract DA-49-007-MD-051.

Data are reported from a study of the hemorrhagic syndrome which was observed associated with the feeding of certain diets containing irradiated beef to rats. Data are included on the effect of control and irradiated beef diets on coagulation factors of intact and castrate male and female mice. The effects of the inclusion of vitamin oils and supplements of vitamins A, D, and E given orally were investigated. Data are tabulated. (C.H.)

12351 NP-7500

Massachusetts Inst. of Tech., Cambridge.

RESEARCH TO DETERMINE WHETHER ANY TOXIC EFFECTS OF PROTEIN QUALITY CHANGES ARE INDUCED IN DRIED WHOLE EGG BY IONIZING RADIATION. Semi-Annual Progress Report for the Period September 14, 1958 to March 15, 1959. B. E. Proctor and S. Miller. Mar. 15, 1959. 12p. Contract DA-49-007-MD-775.

The effect of a diet containing irradiated dried whole eggs on reproduction and lactation in dogs was studied. The condition of dogs maintained for 4 years on a diet including 20% irradiated eggs was good. A possible abnormality in the blood picture of pups from three litters is reported under investigation. Data are tabulated. (C.H.)

12352 NP-7502

Alabama Polytechnic Inst., Auburn.

LONG-TERM RAT AND DOG FEEDING TESTS ON IRRADIATED SWEET POTATOES AND COD FISH. Progress Report. H. D. Alexander and W. D. Salmon. Mar. 15, 1959. 18p. Contract DA-47-007-MD-543.

Data are tabulated on the growth and breeding of rats maintained for three generations on a diet containing irradiated codfish and sweet potatoes. No significant differences in survival or body weight were noted. Dogs maintained for 21 months on a diet containing irradiated codfish and sweet potatoes appear to be thriving as well as those on a similar non-irradiated diet. (C.H.)

12353 NP-7503

Wisconsin Alumni Research Foundation, Madison.

POSSIBLE CARCINOGENICITY OF IRRADIATED FOODS. Progress Report [for] period September 15, 1958 to March 15, 1959. B. E. Kline and L. J. Teply. 2p. Contract DA-49-007-MD-583.

Two hundred mice were injected subcutaneously in the groin three times with a mixture of irradiated corn-cottonseed and peanut oil emulsified with water. They were observed over a 24 month period for the appearance of tumors. Results were compared with a similar group injected with nonirradiated oils. No significant differences were found in tumor incidence and location in the two groups. (C.H.)

12354 NP-7504

Colorado. Univ., Boulder and Army Medical Nutrition Lab., Denver.

THE NUTRITIONAL ADEQUACY AND PROBABLE TOXICITY OF FOODS PRESERVED BY IONIZING RADIATIONS. Progress Report No. 11 [for] period September 1, 1958 to March 15, 1959. Norman F. Witt, Herman F. Kraybill, Merrill S. Read, William S. Worth, and Harold M. Trabosh. 18p. Contract DA-49-007-MD-549.

Data are reported from four studies on the nutritional properties and possible toxicity of foods preserved by radiosterilization. Rats were used as the test animals. Data are included on: growth, liver and blood enzyme activities, and cecal coliform counts in animals maintained on a composite diet of 15 irradiated food items; enzyme studies in animals fed a diet containing irradiated beef; hemorrhagic diathesis in male rats fed irradiated diets; and gross anaphylaxis experiments in animals fed milk treated by exposure to heat, ultraviolet, or ionizing radiations. (C.H.)

12355 NP-7505

Wisconsin Alumni Research Foundation, Madison.

LONG-TERM FEEDING OF IRRADIATED POTATOES. Progress Report No. 2 [for] period September 15, 1958 to March 15, 1959. L. J. Teply, B. E. Kline, and J. J. Birdsall. 18p. Contract DA-49-007-MD-712.

No harmful effects due to radiation were observed in rats maintained for 40 weeks on a diet including 35% of irradiated potatoes. Data are included on the second generation of test animals. (C.H.)

12356 NP-7506

[Illinois. Univ., Urbana.]

TO DETERMINE THE EFFECT OF IRRADIATION UPON THE WHOLESOMENESS OF FOOD. Progress Report No. 7 [for] Period September 1958-March 1959. Elwood F. Reber, Om P. Malhotra, J. P. Kreier, S. L. Issar, P. D. Beamer, J. C. Bartley, P. C. Matchette, and H. W. Norton. 40p. Contract DA-49-007-MD-72800.

No dietary effects were observed in dogs maintained for 72 weeks on a diet including irradiated beef or irradiated flour. The average growth of dogs fed the irradiated beef or flour diet was compared with that of dogs maintained on a ration containing nonirradiated horse meat and wheat flakes. No statistically significant differences were observed. Data are included on a study of hemorrhages in rats fed a nonirradiated diet. (C.H.)

12357 NP-7507

Pennsylvania. Univ., Philadelphia. School of Medicine.

EFFECT OF FOOD PRESERVED WITH IONIZING RADIATION ON RESTORATION OF ENZYME ACTIVITY AND TOTAL PROTEIN OF RAT LIVER. Progress Report No. 3 [for] Period September 1958-March 1959. Otto Rosenthal. 14p. Contract DA-49-007-MD-861.

Preliminary results are reported from a study of the effect of a diet containing heated irradiated beef on the restoration of protein content and enzyme activity of the liver in rats after protein depletion and partial hepatectomy. Assays were made on alkaline phosphatases, rhodanase, and glutamic-oxalacetic acid transaminase levels in liver. (C.H.)

12358 UMRI-2307-11-T

Michigan. Univ., Ann Arbor. Fission Products Lab.

and Michigan. Univ., Ann Arbor. Medical School. GROWTH, REPRODUCTION, MORTALITY, AND PATH-

OLOGIC CHANGES IN RATS FED GAMMA-IRRADIATED POTATOES. Terminal Report. L. E. Brownell, G. D. Abrams, and C. H. Burns, Feb. 1959. 34p. UMRI Project 2307. Contract DA-49-007-MD-581.

For two years a colony of albino rats was fed diets of which one third contained potatoes which had been exposed to ionizing radiation for sprout inhibition. Growth, food consumption, reproductive performance, hematologic changes, mortality, and pathologic changes in these rats were compared with the same in animals fed a non-irradiated potato diet. The growth, reproductive performance, and pathologic changes up to 30 weeks of second- and third-generation animals were also compared with corresponding controls. There were no consistent effects due to irradiation of potatoes which could be established by these criteria. There was a slightly greater mortality rate among males of the first generation fed the irradiated potato diets which was of questionable statistical significance and may be related to the poor condition of the irradiated potatoes relative to the nonirradiated controls. Second-generation males and females fed the irradiated potato diets also experienced a higher mortality rate but this is attributed to genetic factors. An unusually high incidence of a necrotizing arteritis resembling peri-arteritis nodosa occurred in the first- and second-generation animals in this experiment. The combination of a genetic and a dietary factor is implicated in causing this disease, but irradiation of the potatoes is not a factor. Studies are currently in progress on hypertensive vascular disease in descendants of the animals used in the above experiment. (auth)

12359 USNRDL-TR-313

Naval Radiological Defense Lab., San Francisco.
TOTAL EXCHANGEABLE POTASSIUM AND CHLORIDE AND TOTAL BODY WATER IN HEALTHY MEN OF VARYING WATER AND FAT CONTENT. E. A. Boling, W. L. Taylor, C. Entenman, and A. R. Behnke. Mar. 23, 1959. 27p.

During recent years it has been shown that various parameters and functions of body composition, among them exchangeable potassium, sodium, chloride, total red cell mass, plasma volume, indices of extracellular fluid volume, and creatinine excretion, all are quite closely correlated with the size of the lean body mass. This is true not only in man, but in a variety of lower animals. Recent advances in methods have made it possible to measure exchangeable potassium using mixing times of 40 hours. Also, it has been shown that for sick patients, a mixing time at least this long should be used for purposes of accuracy. Most of the data in the literature for exchangeable potassium in healthy men has been gathered using mixing times of 24 hours. In addition, it has been reported that gains or losses of weight have been associated with alterations in both extracellular fluid and total body water. Because of these factors, measurements of exchangeable potassium, exchangeable chloride, and total body water were performed in a group of 36 healthy men of varying water and fat content. The results showed a marked correlation between the amount of exchangeable potassium or chloride in the body and the amount of water in the body. In addition, it was seen that the amount of exchangeable chloride increased in proportion to the relative amount of fat in the body, and decreased in proportion to the relative amount of water in the body. Fat men contained relatively more chloride per unit of body water than did average men, and average men contained more than did lean men. No such relationship was present for the amount of exchangeable

potassium, which was constant, with relation to the body water, over a wide range of water or fat content. (auth)

12360

THE NECESSITY OF INTRODUCING A NEW RADIO-BIOLOGICAL QUANTITY. Radu Grigorovici and Mircea Oncescu. Acad. rep. populare Romîne, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz. 9, 483-8 (1958). (In Rumanian)

A new radiobiological unit is proposed for use with all kinds of radiation. It is defined in terms of the dose absorbed and the relative biological effectiveness. (J.S.R.)

12361

SUB-CHROMATID REARRANGEMENTS IN TRILLIUM ERECTUM. I. ORIGIN AND NATURE OF CONFIGURATIONS INDUCED BY IONIZING RADIATION. G. B. Wilson, A. H. Sparrow, and Virginia Pond (Brookhaven National Lab., Upton, N. Y.). *Am. J. Botany* 46, 309-16 (1959) Apr.

Microsporocytes of *Trillium erectum* were x-irradiated with 25 r at various stages of meiotic prophase and at first metaphase. Analysis of these cells at the following first and second anaphase revealed that post-pachytene irradiation produces 2-side-arm bridges which are indicative of half-chromatid exchanges. The occurrence of these bridges and knowledge of the structure and spatial relationship of chromatid strands in *T. erectum* have led to the conclusion that the most likely target for primary effects is the 4 associated half-chromatids of a half-bivalent. The results of irradiation experiments suggest that the half-bivalent is effectively as well as structurally quadripartite at stages following pachytene. Consideration of the configurations which would result from breakage and rejoining of 2, 3 or all 4 strands of the half-bivalent indicates that only 2 of the 4 half-chromatids are broken by a single event. Exchanges between 2 half-chromatids of sister chromatids will produce two recognizable types of 2-side-arm bridges: one with a true dicentric half-chromatid and one in which the bridge results merely from an interlocking of coils. Whether a 2-side-arm bridge appears at first or second meiotic anaphase is determined by the position and number of chiasmata between the point of breakage and the kinetochore. No 2-side-arm bridges have been detected at microspore anaphase following meiotic prophase irradiation. The types of configurations which might be expected at microspore metaphase as a result of broken 2-side-arm bridges are noted. (auth)

12362

RADIATION INJURY AND MARROW REPLACEMENT: FACTORS AFFECTING SURVIVAL OF THE HOST AND THE HOMOGRAFT. Joseph W. Ferrebee and E. Donnell Thomas (Mary Imogene Bassett Hospital, Cooperstown, N. Y.). *Ann. Internal Med.* 49, 987-1003(1958) Nov.

The treatment of acute radiation injury in man by the transplantation of bone marrow is discussed. Clinical results are reviewed from known cases. Application of radiation therapy and bone marrow injections in the treatment of leukemia are described. (C.H.)

12363

THE LEUKOCYTE RESISTANCE VALUE (LRW) IN ACUTE RADIATION SYNDROME OF RATS. (A POSSIBILITY FOR THE EARLY DETECTION OF RADIATION EFFECTS). W. Dietz and K. Damminger (Univ. Frauenklinik, Freiburg i.B. and Philipps-Universität, Marburg, Ger.). *Atompraxis* 5, 53-9(1959) Feb. (In German)

A method is described which permits a functional diagnosis of the blood forming tissues. The leucocyte resistance value for supersonic waves is affected systematically by radiation damage and thus makes possible an evaluation of the dose received and the reaction ability of the organism within a few hours. The course of the curve in the first few days shows rhythmic fluctuations of the maxima and minima which are dependent upon the dose in regard to both size and time. This simple, cheap, and quick examination method appears suitable for use in case of a catastrophe. (auth)

12364

BONE MARROW TRANSPLANTATION CONFERENCE. Shields Warren and William Dameshek (New England Deaconess Hospital, Boston). Blood **13**, 288-300(1958) Mar.

Problems associated with the therapeutic and experimental uses of bone marrow transplants are discussed. Results are reported from applications in the treatment of patients with leukemia and marrow hypoplasia. Aspiration techniques and immunologic problems are discussed. (C.H.)

12365

CLINICAL AND FUNDAMENTAL ASPECTS OF TRANSPLANTATION OF BONE MARROW. Blood **13**, 1096-1100(1958) Nov.

Observations on reactions to transplanted bone marrow are summarized. (C.H.)

12366

CERTAIN STRUCTURAL ASPECTS OF LYMPHOCYTES AND MONOCYTES IN RELATION TO THE CLINICAL CONDITION OF PERSONS EXPOSED TO IONIZING RADIATION. D. O. Shiels. Brit. J. Radiol. **32**, 306-14(1959) May.

Data are tabulated on the morphology of lymphocytes and monocytes relative to physical condition of persons occupationally exposed to ionizing radiation. (C.H.)

12367

ELECTRON THERAPY AT 8 Mev. A. Batchelor, D. K. Bailey, Robert Morrison, and J. A. Stevenson (Hammer-smith Hospital, London). Brit. J. Radiol. **32**, 332-8(1959) May.

The use of an 8 Mev linear accelerator for the treatment of patients with electrons is described. Dose distributions in water show a zone extending from the surface to a depth of 2.4 cm in which the irradiation is uniform to within 20 per cent, with a steep decline at greater depths. It is considered that effective treatment can be given only to a depth of 2.4 cm. The types of case which can be treated with 8 Mev electrons are discussed and a few treatments which have been given are described. (auth)

12368

FURTHER STUDIES ON THE EFFECT OF PARTIAL SHIELDING BY GRIDS ON SURVIVAL OF X-IRRADIATED RATS. J. G. Kereiakes and A. T. Krebs (Army Medical Research Lab., Fort Knox, Ky.). Brit. J. Radiol. **32**, 339-41(1959) May.

Exposure of rats to the same mid-line doses of x-irradiation through grids of various ratios of open area to closed area but a constant diameter hole size resulted in significantly greater survival only for small ratios of open area to closed area. These results are in contrast to the findings found for selective shielding-type experiments, where the effect depends on the sensitivities of the shielded portions. (auth)

12369

THE RECOVERY OF X-IRRADIATED SALMONELLA TYPHIMURIUM BY MEANS OF HIGHLY POLYMERIZED DEOXYRIBONUCLEIC ACIDS (DNA). D. T. Kanazir, O. Ž. Čečuk, B. N. Krajinčanić, and T. A. Hudnik. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 133-44(1959).

Reported data suggest that the postirradiation treatment of UV and x-irradiated S. typhimurium with highly polymerized isologous deoxyribonucleic acid (DNA) may prevent the death induced by radiation. In irradiated cultures treated with isologous DNA the number of colony forming survivors was increased, whereas in untreated control cultures this number continuously decreases. The recovery reflected the reestablishment of cell division mechanism impaired by radiation. This effect of highly polymerized isologous DNA can not be considered as a nutritional one, since it has not been observed with isologous DNA digests, or with lower molecular weight DNA derivatives, or with heterologous DNA. (auth)

12370

EFFECTS OF HIGHLY POLYMERIZED NUCLEIC ACIDS AND THEIR DERIVATIVES UPON THE RECOVERY OF IRRADIATED RATS. D. Kanazir, A. Bečarević, B. Panjevac, M. Simić, and G. Ristić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 145-53(1959).

Reported data showed an important 30-day survival of total body irradiated rats (LD₁₀₀) treated with highly polymerized spleen and liver isologous nucleic acids. No delayed death was observed among surviving rats during a postirradiation period of 10 months. But, neither the depolymerized isologous nucleic acids, nor their lower molecular weight derivatives showed any effect upon the survival of irradiated animals. (auth)

12371

PARTIAL RESTORATION OF HEMOLYSIN-FORMING CAPACITY IN X-IRRADIATED RATS BY HOMOLOGOUS SPLEEN DEOXYRIBONUCLEIC ACID. Miroslav M. Simić, Milica Ž. Petković, and Desanka D. Mančić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 155-64(1959).

The effect of highly polymerized homologous spleen deoxyribonucleic acid on the hemolysin-forming capacity in total-body-irradiated rats with 600 r was reported. The results suggest that DNA treated rats produce more hemolysin and at a higher rate than irradiated controls. (auth)

12372

AN HISTOCHEMICAL STUDY OF THE EFFECTS OF X-RADIATION ON THE ALKALINE PHOSPHATASE IN THE SPLEEN AND THE KIDNEY OF C 57 MICE. S. Hajduković and D. Rašković. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 174-9(1959).

The effect of x radiation on the activity of alkaline and acid phosphatase of spleen and kidney in C 57 black mice was reported. With all doses given (1000 r, 700 r, 500 r, 300 r) the activity of alkaline phosphatase in spleen and kidney was found to be increased. (auth)

12373

RETICULOCYTE REACTIONS OF MICE UNDER THE INFLUENCE OF DIRECT RADIATION AND OF THE SERUM OF IRRADIATED ANIMALS. S. Hajduković and Lj. Stošić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 181-7(1959). (In French)

Black C₅₇ mice, divided into two groups weighing 10

and 20 g, showed early reticulocytosis after a dose of 600 and 1200 r, respectively. The blood serum of newly born mice cause reticular growth in the two groups which appears four hours after the application of the serum. The blood serum of young mice receiving 600 r has the same stimulating qualities for reticulocytes. These results confirm the existence of a radiation-induced nonspecific reticulocytosis observed previously in rats. (tr-auth)

12374

THE INFLUENCE OF X-RAYS ON THE ACTIVITY OF DESOXYRIBONUCLEIC ACID IN THE URINE, SERUM, BONE MARROW, AND SPLEEN OF THE NORMAL AND SPLENECTOMIZED RAT. M. Jovanović and A. Vončina. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 9, 189-98(1959). (In French)

The spleen is one source of desoxyribonucleic acids. The modifications of the activity of this enzyme in the blood serum, urine, bone marrow, and spleen was studied as a function of the x-radiation dose received by the rat and of the time after irradiation. After 400 r there is an increase of the enzymatic activity in the blood serum and the urine. The spleen activity is increased only after 500 r. 100 r causes an increase in the bone marrow. Splenectomy alone produces increased enzyme activity in the urine, blood serum, and bone marrow, but irradiation does not affect the activity in the splenectomized animal. Spleen extract of young rats, injected immediately after splenectomy, shows an inhibitory effect with respect to desoxyribonucleic acid in the bone marrow. (tr-auth)

12375

THE PROTECTIVE EFFECT OF BECAPTAN UPON SURVIVAL OF YOUNG RATS EXPOSED TO SUB-LETHAL AND LETHAL DOSES OF X-RAYS.

D. Radičević, N. Savković, and Dj. Sladić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 9, 205-8(1959).

A study was made to determine what part Becaptan would play in the protection of young rats irradiated before and after the appearance of the stress reaction, after sublethal (600 r), and lethal doses (800 and 850 r) of x-radiation. The results show that the effect of the stress reaction supplements the action of becaptan, the per cent surviving being always greater in the presence of this mechanism. (auth)

12376

THE UPTAKE OF P^{32} BY THE PITUITARY AND ADRENAL GLANDS OF THE RAT FOLLOWING X IRRADIATION. S. D. Sladić, D. Pavić, and D. Radičević. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 9, 209-11(1959).

The influence of ACTH on phosphorus uptake when x rays were used as a stressor was investigated. Both hypophysectomized and nonhypophysectomized rats were used. The uptake of P^{32} by the adrenal glands and the hypophysis was determined for a period of 72 hrs following irradiation. In comparison with normal controls, the uptake of P^{32} by the adrenal glands of non-hypophysectomized rats 1 hr after irradiation was increased; at 24 hrs after irradiation returned to normal values; at 48 hrs it was slightly increased; and at 72 hrs it became markedly increased. No changes in concentration of P^{32} in the anterior pituitary of the irradiated rats were ever observed. The same applies to the adrenal glands of hypophysectomized rats irradiated for the same time period. (auth)

12377

A COMPARISON OF LOWER AND HIGHER PLANTS AS ACCUMULATORS OF RADIOACTIVE FALL-OUT.

Eville Gorham (Freshwater Biological Assn., Ambleside, Eng.). Can. J. Botany 37, 327-9(1959) Mar.

A comparison was made of the radioactivity of ash from lichens, mosses, and angiosperms collected in the English Lake District during 1958. The mosses and lichens were found to be considerably more radioactive than the angiosperms. It is presumed that the greater surface area per unit dry weight of tissue, and their habits of growth as mats or cushions on the soil surface enhance their ability to accumulate fall-out materials from run-off. (C.H.)

12378

IRRADIATION EFFECTS ON MALIGNANT CELLS IN SMEARS FROM ORAL CANCERS. William Umiker, Isadore Lampe, Robert Rapp, Howard Latourette, and Delbert Boblitt (Veterans Administration Hospital and Univ. of Michigan, Ann Arbor). Cancer 12, 614-19 (1959) May-June.

The cytological expression of radiation effect on malignant cells reflects accentuation of the unaltered morphology of the individual neoplasms, degeneration or complete destruction, maturation, and in about 50% of the cases, a temporary decrease in cohesiveness of the malignant tissue. Malignant cells were present in oral smears at the completion of irradiation in the majority of oral carcinomas, but sometimes disappeared after treatment. No cytological conversions were noted after the eighth week from the time of institution of irradiation. Destruction of malignant cells by irradiation appears to be much more important than does radiation-induced tumor differentiation. Increased exfoliation of malignant cells was noted in one-half of the cases, between the ninth and eighteenth days of treatment, probably due to decreased cohesiveness of the neoplastic tissue rather than to stimulation by irradiation. Abundant exfoliation of carcinoma cells may indicate an increased likelihood of metastases. (auth)

12379

FRACTIONATED X-RAY DOSE AND CHROMOSOME ABERRATIONS IN BARLEY. H. K. Jain and P. K. Mujumder (Indian Agricultural Research Inst., New Delhi). Current Sci. (India) 28, No. 1, 8-9(1959) Jan.

Data are tabulated on the frequencies of re-unions and breaks in chromosomes in barley root tips exposed to 2,400 r x radiation given continuously or divided into two equal fractionations separated by 2, 4, 6, and 8 hours. Data are summarized in tabular form, and results are discussed. (C.H.)

12380

ALTERATION OF THE REDOX POTENTIAL IN POTATO SHOOTS EXPOSED TO X-RAY TREATMENT. I. M. Vasil'ev and O. I. Parfenova. Doklady Akad. Nauk S.S.S.R. 125, 401-3(1959) Apr. 11. (In Russian)

Experiments were carried out in order to determine the redox potential of irradiated potato shoots. The graph of 16 experiments for determining the Eh immediately before and during the irradiation of the screened potato shoots did not show any appreciable effects. The results of 18 irradiations of nonscreened shoots with 3000-r at 87 r/m showed an increase in Eh at the beginning of the irradiation and a drop after the irradiation. In some instances the Eh was lower than the initial. A similar picture was observed with increased irradiations up to 5000-r at 260-r/min. It was concluded that

the rise in redox potential at the beginning of the irradiation is the result of oxidation of products, and the subsequent drop in redox potential must be caused by the life cells correcting the radioinduced harmful alterations. (R.V.J.)

12381

THE EFFECT OF X-RAY TREATMENT ON THE MITOTIC ACTIVITY OF THE CORNEA. N. I. Nuzhdin and O. P. Domareva (Inst. of Genetics, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 404-7(1959) Apr. 11.

The mitotic activity of white mice cornea during whole-body exposures to 100, 600, and 800 r was studied. The tabulated data show that the mitotic activity of the cornea epithellum exposed to 600 and 800 r is restored after 3 to 5 days; with the exposure to 100 r it is restored after 6 hours. However, the effects of irradiation are observed for a long time. A great number of pathological mitoses was observed after 5 days. (R.V.J.)

12382

VARIATION IN THE RADIO-SENSITIVITY OF THE EGGS OF *MISGURNUS FOSSILIS* L. OBSERVED IN THE COURSE OF THE FIRST EMBRYONIC MITOSES.

V. N. Belyaeva and G. L. Pokrovskaya (Inst. of Biological Physics, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 632-5(1959) Mar. 21. (In Russian)

Experiments showed that the radiosensitivity of *Misgurnus fossilis* L. eggs during early embryonic mitosis (determined by the percentage of chromosome changes, the amount of perished eggs, and the number of deformed progeny spawned) changes regularly with the mitotic phase cycle. The highest radiosensitivity was observed during the anaphase with the first appearance of cleavage in the developing eggs. The radiosensitivity is also high during the prophase period and results in increased chromosome alterations and an increased number of deformed progenies. The interphase cells are less radiosensitive. It was found that during the radiosensitive period, even 50 r can destroy up to 30% of the eggs and induce a great number of deformities. The data illustrate the relation between the survival of embryo and morphological injuries and the radiation effects on the cell structure. (R.V.J.)

12383

THE ROLE OF DIRECT OR DISTANCE EFFECT OF X-RAY TREATMENT IN THE RESPONSE REACTION OF AN ORGANISM. N. I. Nuzhdin and O. P. Domareva (Inst. of Genetics, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 650-3(1959) Mar. 21. (In Russian)

The effects of direct and indirect irradiation on cornea epithellum during mitosis were studied. The experiments were carried out with 2 and 3 months old white mice exposed to whole-body and screened head irradiations of 600 and 800 r. Data showed that the irradiation depressed the mitotic division of cornea cells. With whole-body exposure the depression begins during the irradiation; the 800 r dose completely depressed the mitotic division of cornea cells after 6 hours and with 600 r only separate single units of mitosis were observed. The depression of mitotic activity in cornea epithellum of screened head irradiation had two peak maxima, one after 2 hours and the second after 10 hours. Hence, a different mechanism in direct and indirect exposures is indicated. (R.V.J.)

12384

ON CHROMOSOME ABERRATIONS AND MITOTIC ACTIVITY SUBSEQUENT TO EXPOSURE TO IONIZING RADIATION UNDER CONDITIONS OF PROTECTION WITH CARBON MONOXIDE ON THE PROBLEM OF REPARATION OF RADIATION INJURY. I. M. Shapiro and M. M. Kostantinova (Severtsov Inst. of Animal Morphology, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 654-7(1959) Mar. 21. (In Russian)

Data are reported on the chromosome aberrations and mitotic activity in mice subsequent to irradiation with 900 r of Co^{60} γ rays (565 r/min) protected by carbon monoxide. It is shown that hypoxia during irradiation is a helpful factor in the regeneration of the mitotic ability of cells. (R.V.J.)

12385

THE EFFECT OF RADIOACTIVE SUBSTANCES UPON BARLEY PLANTS, AS DEPENDENT ON THE DEVELOPMENT STAGE WHICH PROCEEDED UNDER SHORT-DAY CONDITIONS. K. S. Mirolubov (Leningrad Inst. of Agriculture). *Doklady Akad. Nauk S.S.S.R.* **125**, 670-2(1959) Mar. 21. (In Russian)

The effects of radioactive substances on the growth and development phases of plants were studied. The tabulated data indicate a favorable effect produced by the radioactive substances under short-day conditions, mainly during the daylight period. (R.V.J.)

12386

URANIUM TOXICITY. C. Garavaglia (Univ. of Milan and CISE, Milan). *Energia nucleare (Milan)* **6**, 141-6(1959) Feb. (In Italian)

The mechanism of uranium poisoning according to the most recent studies is reported. Soluble and insoluble natural uranium are primarily considered. Chemical toxicity and radiological hazards are closely related and at present it is believed that chemical toxicity prevails for soluble uranium and radiological toxicity for insoluble uranium. The toxicity of enriched uranium and U^{233} is briefly discussed. The radiological toxicity prevails in U^{233} in both soluble and insoluble forms. The maximum permissible concentration of natural uranium and U^{233} in the air is reported. 22 references. (auth)

12387

INCREASE OF THE YIELD AND QUALITIES OF CROPS BY IRRADIATION OF THE SEEDS. Pierre Vidal. *Inds. atomiques* **3**, No. 1-2, 77-84(1959). (In French)

A survey is made of the work done on the improvement of crop yield and quality by the irradiation of the seeds. X radiation, gamma rays, electrons, and neutrons are the types of radiation used. The stimulating effects of radiation is briefly described, and the actual state of the investigations is briefly summarized. Some typical results are given. (J.S.R.)

12388

OXIDATION OF REDUCED DIPHOSPHOPYRIDINE NUCLEOTIDE BY *CLOSTRIDIUM PERFRINGENS*. I. RELATION OF PEROXIDE TO THE OVER-ALL REACTION. M. I. Dolin (Oak Ridge National Lab., Tenn.). *J. Bacteriol.* **77**, 383-92(1959) Apr.

The characteristics of reduced diphosphopyridine nucleotide oxidation reactions, as catalyzed by crude and purified extracts, are discussed in relation to the mechanisms of anaerobiosis. Results are reported from studies using oxidase from *Clostridium perfringens* and *Azotobacter agile* to catalyze the reduc-

tion of oxygen to water, using reduced diphosphopyridine nucleotide as the hydrogen donor. (C.H.)

12385

OXIDATION OF REDUCED DIPHOSPHOPYRIDINE NUCLEOTIDE BY CLOSTRIDIUM PERFRINGENS. II. PURIFICATION OF THE OXIDASE; RELATION TO CYTOCHROME c REDUCTASE. M. I. Dolin (Oak Ridge National Lab., Tenn.). *J. Bacteriol.* 77, 393-402(1959) Apr.

Electrophoretic data strongly suggest that the native reduced diphosphopyridine nucleotide oxidase is also a cytochrome c reductase and that spontaneous or irradiation-induced (near ultraviolet) loss of the four-electron transfer reaction leads to conversion of the enzyme to a cytochrome c reductase devoid of oxidase activity. The altered enzyme has different physical properties from the original, native oxidase. In addition to the change in physical properties of the enzyme, there is some change in catalytic properties at the cytochrome reductase locus. Results are presented of studies using purified nucleotide oxidase of *Clostridium perfringens* which support this theory. (C.H.)

12390

VARIATION TO RADIATION RESISTANCE IN NOCARDIA CORALLINA. J. B. Clark and Janice Frady (Univ. of Oklahoma, Norman). *J. Bacteriol.* 77, 414-16(1959) Apr.

Cultures from fresh isolates of *Nocardia corallina* displayed a wide variation in dose-survivor response to both x radiation and ultraviolet light. Cultures more sensitive to irradiation than the parent strain were found to be composed of a high percentage of bacillary cells, which were probably the cause of the sensitivity. Cultures with extreme resistance to irradiation were found, but these reverted on subculture or standing to become similar in response to the parent culture. This transient radiation resistance is thought to be due to a recessive allele and is presumably lost through heterocaryon formation. Isolates of three bacterial cultures did not display the extreme variation in radiation response found in *N. corallina*. (auth)

12391

EFFECT OF IRRADIATED FATTY ACIDS ON THE GROWTH OF *ESCHERICHIA COLI*. Edgar F. Stillwell, Samuel P. Maroney, Jr., and Karl M. Wilbur (Duke Univ., Durham, N. C.). *J. Bacteriol.* 77, 510-11(1959) Apr.

The relation between the inhibition of growth and the degree of oxidation of fatty acids and their esters was studied in cultures of *Escherichia coli*. The effects of ultraviolet irradiation on the formation of peroxides and other oxidation products were measured. (C.H.)

12392

INFLUENCE OF RIBONUCLEOTIDES ON THE UTILIZATION OF DEOXYRIBONUCLEOTIDES BY *LACTOBACILLUS ACIDOPHILUS*. A. J. Siedler and B. S. Schweigert (Univ. of Chicago). *J. Bacteriol.* 77, 514-15(1959) Apr.

The nutritional requirements of *Lactobacillus acidophilus* were studied. Tabulated data are presented. (C.H.)

12393

A SEROLOGICAL AND ELECTROPHORETIC STUDY OF DIPHTHERIA ANTISERA IRRADIATED WITH STERILIZING DOSES OF γ -RAYS. D. R. Kaulen and O. V. Chakhava (Gamaleia Inst. of Epidemiology and Microbiology, Academy of Medical Sciences, U.S.S.R.).

J. Microbiol. Epidemiol. Immunobiol. (USSR) (English Translation) 29, 1397-1404(1958).

The effects of irradiation on the antitoxic, anaphylactic, and electrophoretic properties of diphtheria antisera were studied at the various doses used for sterilization. Both crude and purified diphtheria antitoxic antisera were used. Irradiations were carried out with a cobalt-60 source with a total power of 5 kc. The dosage rate was 600 r/min. Data are tabulated. The results demonstrate considerable changes in the properties of antisera taking place as a result of exposure to large doses of gamma radiation. In all experiments a regular fall in the antitoxin titre was demonstrated. A greater destruction of antitoxin was observed in the crude antiserum than in the purified. Possible reaction mechanisms involved are discussed. (C.H.)

12394

INFLUENCE OF TOTAL BODY X-IRRADIATION ON THE ACID AND ALKALINE PHOSPHATASES, GLUCOSE-6-PHOSPHATASE, ATPASE AND PHOSPHORYLASE ENZYMES IN RATS. M. B. Sahasrabudhe, A. D. Rahalkar, and M. K. Nerurkar (Atomic Energy Research Establishment, Trombay, India), and D. K. Mahajan (Indian Cancer Research Centre, Parel, Bombay). *J. Sci. Ind. Research (India)* 18c, 34-8(1959) Feb.

Activities of acid and alkaline phosphatase, ATPase, glucose-6-phosphatase, and phosphorylase have been studied in plasma, liver, intestine, kidney, and muscle of Wistar rats, exposed to 600 r of total-body x irradiation. Data are presented to indicate that the levels of acid and alkaline phosphatase and ATPase, in all the tissues studied, increase while those of glucose-6-phosphatase and phosphorylase decrease markedly within 24 hr following irradiation. *In vitro* irradiation studies of crude preparations of phosphatase enzyme suggest that the action of x irradiation on phosphatase enzymes is not direct. (auth)

12395

THE MEDICAL SERVICE IN A CENTER OF APPLIED NUCLEAR RESEARCH: PURPOSES, ORGANIZATION AND WORKING METHODS. G. Garavaglia, E. Ghislandi, and C. Polvani (Univ. of Milan). *Med. lavoro* 49, 572-90(1958). (In Italian)

The purposes, organization, and working methods of a medical service at a nuclear center which has operated for several years in Italy are examined. The relationship of the medical service to the health physics service is particularly considered. The variation of the structure of the medical service from that found in conventional plants is discussed. A code for defining and classifying occupational risks and absorbed doses is presented. (J.S.R.)

12396

A CHAMBERED MICROSCOPE SLIDE. Richard A. McGrath (Oak Ridge National Lab., Tenn.). *Microscope* 12, No. 3, 3p.(1958) Nov.-Dec.

A stainless-steel chambered microscope slide is described which proved useful in microscopic examination of cell suspensions, hanging-drop preparations, tissue cultures, and smears. (C.H.)

12397

INVESTIGATION ON THE BIOLOGICAL EFFECT OF FAST ELECTRONS PRODUCED IN THE BETATRON. COMPARATIVE ANALYSIS OF THE MODIFICATION INDUCED BY ELECTRONS AND X RADIATION ON THE REABSORPTION OF RADIOIODINE IN THE

HUMAN SKIN. Y. Anno, C. Biagini, and V. De Pascalis (Universita, Rome). *Minerva nucleare* 3, 39-44(1959) Feb. (In Italian)

The clearance of radioiodine injected intradermally in the human skin was studied after irradiation with 600 rep of 4-Mev electrons, and the results were compared with the effects of 55 kv_M x rays. The re-absorption of I^{131} was also studied in unirradiated subjects, and the results were considered in relation to the time, the age of the patients, and the site of injection. The reabsorption time of I^{131} appears to increase ten minutes to one hour after irradiation, and to decrease after 1 to 7 days. No quantitative differences were observed between the effects of electrons and those of x rays. The results and their relationship with vascular changes were discussed. (auth)

12398

A SEX DIFFERENCE IN RADIOACTIVITY OF ARTEMIA CULTURED IN SEA WATER CONTAINING PHOSPHORUS-32. Daniel S. Grosch (North Carolina State Coll., Raleigh) and Mary Ellen Plumb (Marine Biological Lab., Woods Hole, Mass.). *Nature* 183, 122-3(1959) Jan. 10.

Phosphorus-32 was added in known concentration to sea water containing adult brine shrimp, *Artemia salina*. Geiger-Mueller counts were made of individual adults and of samples of the sea water over a significant period of time. Females were found to be more radioactive than males. The possible importance of sex in radioecological studies is discussed. (C.H.)

12399

OXIDATION OF RADIOACTIVITY GLUCOSE BY AERATED SLUDGE. Nandor Porges, Aaron E. Wasserman, William J. Hopkins, and Lenore Jasewicz (Dept. of Agriculture, Agricultural Research Service, Philadelphia). *Sewage and Ind. Wastes* 30, 776-82(1958) June.

Treatment of organic waste by aerated sludge depends on the metabolic activities of many microorganisms present in the mixed liquor. A study was made of carbohydrate dissimilation by sludge organisms present in organic wastes. Radioactive glucose, labeled at the carbon-1 or carbon-6 atom, was used to follow the fate of the glucose molecule with respect to CO_2 evolution and sludge formation. Results indicate that the glucose molecule is degraded, and the component carbon atoms are used at various rates and enter into a number of reactions. (C.H.)

12400

MEASURING TECHNIQUES AND AUTORADIOGRAPHIC DETECTION OF TRITIUM-LABELED ORGANIC SUBSTANCES, USING AS EXAMPLE ARGININE.

Emil Heinz Graul and Heinz Hundeshagen (Univ. of Marburg, Ger.). *Strahlentherapie* 108, 524-30(1959) Apr. (In German)

The importance of tritium as a tracer isotope in medical and biochemical research is increasing due to a number of favorable qualities. These qualities were discussed and methods for labeling of organic substances, particularly the amino acid arginine, were reported. Autoradiographic slides of different tissues after injection of tritium labeled arginine show great contrasts, produced by the soft beta radiation of tritium. The activities directly over nuclei can be localized for example. It was pointed out that by autoradiography only radioactivity can be determined. By means of an example it was demonstrated how the radioactivity of tritium can be attributed to certain metabolic cycles. (auth)

12401

THE RADIATION DAMAGE OF BIOLOGICAL OXIDATION. Johannes Pany (Univ. of Vienna). *Strahlentherapie* 108, 531-8(1959) Apr. (In German)

The course of biological oxidation depending on the time after irradiation with a lethal dose of 800 r was studied on rats and guinea pigs. It was observed that cytoplasm under different conditions (cytoplasm of irradiated and unirradiated animals) has no effect on the radiation damage of liver mitochondria in vitro. The oxygen uptake showed little or no change in organs with little sensitivity to irradiation such as liver and kidney. But there was a marked but temporary inhibition of the oxygen uptake in the sensitive organs such as spleen and small bowel. The temporary regeneration is followed by the disappearance of biological oxidation in the small intestine, accompanied by the appearance of hemorrhages. The activating of magnesium on enzymes was also studied under these conditions. (auth)

12402

PARTIAL BODY IRRADIATION OF RATS WITH HIGH X RADIATION DOSES. Helmut Hobitz, Otto Rainer, Ludwig Sattler, and Dimitrij Lang (Max-Planck-Institut für Biophysik, Frankfurt am Main). *Strahlentherapie* 108, 543-7(1959) Apr. (In German)

The left adrenal gland or the small bowel, or the adrenal gland and another organ of the upper abdomen of rats whose right adrenal had been removed, were isolated and irradiated by 7500 r each. The survival time was more shortened if a large part of small intestine or the adrenal and small intestine were irradiated. The conclusion was drawn that after irradiation in the upper abdomen with high doses the death of the animals is not due to a general radiation intoxication, proportional to the integral dose but due to radiation damage of certain organs. (auth)

12403

SUBSEQUENT CHANGES IN THE SPINAL CORD AFTER RADIATION THERAPY OF A CARCINOMA OF THE LARYNX. Alois Sebek, Rudolf Rubes, and Hynek Venclik (Kreislärstitut für Volksgesundheit, Ceske Budejovice, Czechoslovakia). *Strahlentherapie* 108, 567-73(1959) Apr. (In German)

The authors describe a case of malacia of the cervical region of the spinal marrow, which had occurred two years after a laryngectomy and deep x-ray therapy for a carcinoma of the larynx. Clinically the changes became evident through paresthesias, passing into complete quadraparesis. In histological examinations a productive obliterating arteritis was proved in the softened part of the lower cervical marrow. The authors ascribe the myelomalacia to the vascular changes after the irradiation. (auth)

12404

CHANGES IN THE VERTEBRAL COLUMN AND PELVIC BONES AFTER IRRADIATION IN THE INFANTILE AGE. Jaromir Kolar (Karls-Universität, Prague). *Strahlentherapie* 108, 574-80(1959) Apr. (In German)

The author reports on 6 cases of growth inhibition of the vertebral column and of the pelvic bones after irradiation in the infantile age. A short survey outlines the present state of knowledge concerning this question. The author points out that the observed changes are due to the combined effect of the immediate irradiation of the growing bone and of an injury to the trophic influence of the spinal nerves on the growth. Such consequences cannot be avoided for cases in which the irradiation is

founded on vital indications; unjustified irradiations, however, which might lead to similar changes, have to be rejected categorically. (auth)

12405

X-RAY THERAPY OF BURNS IN THE ACUTE STAGE. Alfons Hillel and Mitica Cristescu (Krankenhäuser für Erwachsene, Braila, Romania). Strahlentherapie 108, 581-4(1959) Apr. (In German)

X-ray therapy was used in the treatment of burns in the initial acute period, with success. The most striking feature is the rapid disappearance of edema with desinfiltration and loss of pain. (auth)

12406

NUMBER OF CASUALTIES AND THE DAMAGE AFTER THE ATOMIC BOMB ATTACK ON HIROSHIMA AND NAGASAKI. Hubert Kelm (Univ. of Freiburg i. B.). Strahlentherapie 108, 594-601(1959) Apr. (In German)

Based on official Japanese and American documents, review of the pertinent literature, and principally interviewing Japanese physicians and victims of the atomic bombs in Japan, the number of casualties and the extent of damage caused by the atomic bombs are reported. The conditions immediately following the explosion are described, and the cause of the different physical damages is discussed. (auth)

12407

THE RADIATION DAMAGE FROM LOCAL FALL-OUT IN THE JAPANESE FISHERMEN NEAR BIKINI WITH SPECIAL CONSIDERATION OF THE ONE FATALITY. Hubert Kelm (Univ. of Freiburg i. B.). Strahlentherapie 108, 602-8(1959) Apr. (In German)

The radiation damage of the Japanese fishermen near Bikini, caused by local fall-out is described, taking into consideration the possible cause of death of the one fatal case. (auth)

12408

LATE DAMAGE AFTER THE ATOMIC BOMB EXPLOSION IN JAPAN. Gerhard Jensen (Allgemeinen Krankenhäuser St. Georg, Hamburg). Strahlentherapie 108, 609-16(1959) Apr. (In German)

The extent of late damage caused by the explosion of the atomic bombs is reported. The report is based on impressions in Japan, discussions with Japanese physicians in Japan, and the review of the pertinent literature. (auth)

12409

PARTIAL REPORT ON THE STUDY PERIOD IN JAPAN FROM SEPTEMBER TO NOVEMBER 1957. Josef J. Gomer (Univ. of Heidelberg, Ger.). Strahlentherapie 108, 617-33(1959) Apr. (In German)

The paper is based on the experience of a 3 months' educational trip to Japan. Topics investigated include the pathology of radiation sickness and its problems in differential diagnosis in humans, the formation of keloids caused by the explosion heat of atomic bombs, the changes in male and female gonads and intrauterine-exposed children, the daughter generation-1 of radiation damaged parents in view of physical and intellectual development, and problems of radiation genetics. (auth)

12410

INJURIES FROM SECONDARY RADIATION EFFECTS AND THE DOSIMETRY OF THE RESIDUAL ACTIVITY IN THE ATOMIC BOMBED TOWNS OF HIROSHIMA AND NAGASAKI. Josef J. Gomer (Univ. of Heidelberg, Ger.). Strahlentherapie 108, 634-8(1959) Apr. (In German)

The residual radioactivity caused by nominal atomic bombs and problems of dosimetry are discussed, based on experiences in Japan. (auth)

12411

PENETRATING GUNSHOT WOUNDS OF THE ABDOMINAL CAVITY IN ACUTE RADIATION SICKNESS. Yu. M. Lubenskii (Lubenskiy). Translated from Voenno-Med. Zhur. No. 7, 50-3(1958). p.76-9 of JPRS-(NY)-870, \$3.00(OTS).

The pathology of penetrating gunshot wounds of the abdominal cavity during radiation sickness was studied in 50 dogs. Observations were made on the process of healing of the injured tissues, body temperature, weight, and blood changes. The combined injuries induced characteristics radically different from the usual wounds of the abdominal cavity. These pathological changes are described. (C.H.)

12412

THE USE OF MORPHINE-ETHER ANESTHESIA DURING PRIMARY SURGICAL TREATMENT OF GUNSHOT WOUNDS OF THE INTESTINE IN VARIOUS PERIODS OF ACUTE RADIATION SICKNESS. F. I. Gorelov. Translated from Voenno-Med. Zhur. No. 7, 53-5(1958). p.80-4 of JPRS-(NY)-870, \$3.00(OTS).

The effects of morphine-ether anesthesia were studied in 64 dogs suffering with gunshot wounds of the intestine during various stages of radiation sickness. It was concluded that primary treatment of gunshot wounds of the intestine may be conducted under morphine-ether anesthesia during various periods of acute radiation sickness, but is best used during the primary reaction or during the period of resolution of acute radiation sickness. A sudden cessation of respiration, and even death, occurred more often during inhalation anesthesia administered during the acute stage of radiation sickness. (C.H.)

12413

DEVELOPMENT OF BONE CALLUS AFTER CLOSED FRACTURES OF TUBULAR BONES IN RADIATION SICKNESS. N. V. Koporulin, S. I. Volkov, and I. A. Syts'ko. Translated from Voenno-Med. Zhur. No. 7, 56-8(1958). p.85-8 of JPRS-(NY)-870, \$3.00(OTS).

The process of formation of bone callus in rabbits suffering from radiation sickness was suppressed during the first 5 to 15 days after fracture. (C.H.)

12414

RADIATION DAMAGE AND MINERAL METABOLISM. INVESTIGATION WITH X IRRADIATION ON SACCHAROMYCES CEREVISIAE. H. Engelhard, K. E. Schneweis, and H. Bülow (Univ. of Göttingen, Ger.). Z. Naturforsch. 14b, 152-7(1959) Mar. (In German)

In the present investigation yeast cells (Saccharomyces cerevisiae) were exposed to x radiation and the dependence of the survival rate, the metabolic processes, and the ion transfer processes on the radiation dose were simultaneously determined. The significance of the results in relationship to those obtained in other investigations shows that the sites which control the ion transfer do not contain the fermentation enzymes and that the control sites for the survival and the ion transfer are not the same. Investigations with cysteine make it possible to differentiate between the temperature independent primary energy absorption and the temperature dependent consequences in the radiation damage of yeast cells as it is in the denaturation of albumen. (tr-auth)

12415**EFFECT OF X RADIATION ON CELL METABOLISM.**

I. THE X RADIATION EFFECTS ON GAS METABOLISM AND GLYCOLYSIS OF ISOLATED TISSUE. Francesco Bresciani, Klaus Dose, and Boris Rajewsky (Max-Planck-Institut für Biophysik, Frankfurt am Main). *Z. Naturforsch.* **14b**, 158-68(1959) Mar. (In German)

X irradiation of isolated rat diaphragm with 10 to 200 kr produces a change in tissue metabolism which is schematized in two successive phases. The first phase shows increase of oxygen consumption proportional to the dosage, and an even greater increase of CO₂ production, and inhibition of anaerobic glycolysis. The second phase shows reduction of oxygen consumption proportional to the dosage (over 65 kr the QO₂ decreases below the control), an even greater decrease of CO₂ production, and a greater inhibition of anaerobic glycolysis. With 200 kr or more no increase of respiration appears, but instead, from the beginning, there is a reduction of the metabolism as described in the second phase. A similar effect is found in rat liver and in frog heart tissue. When the tissue was incubated in the homologous serum no change in the quality of the described effect was observed. Under the experimental conditions the tissue was x irradiated within a small quantity of incubation medium and immediately afterwards placed in a fresh medium; this limits the effect of oxidative radicals (arising in the x-irradiated water) upon the tissue. The experimental hypothesis that all the changes described in the metabolism of the cell after x irradiation depend upon a primary alteration of electrolyte balance in the cell, especially of the potassium/sodium relationship was suggested. The well known decrease of glycolysis after x irradiation is a consequence of the loss of potassium from the x-irradiated cell. (auth)

12416

THE DEVELOPMENT OF RADIOCATARACTS IN DEPENDENCE ON THE GENOTYPE. AN INVESTIGATION ON THE RABBIT LENS. U. Ehling and E. Krokowski (Max-Planck-Institut für vergleichende Erbbiologie und Erbpathologie, Berlin-Dahlem and Freien Univ., Berlin). *Z. Naturforsch.* **14b**, 201-5 (1959) Mar. (In German)

The radiosensitivity of organ systems in rabbits and mice is dependent on the genotype. The radiosensitivity of crystalline lens of rabbits is determined by the alleles of the A-gene. These facts open new ways for the investigation of the nature of radiation effects. (auth)

12417

PROGRESS IN NUCLEAR ENERGY. SERIES VII. MEDICAL SCIENCES. VOLUME 2. Edited Proceedings of the Second International Conference on the Peaceful Uses of Atomic Energy, Geneva, 1958. J. C. Bugher, J. Coursaget, and J. F. Loutit, eds. New York, Pergamon Press, 1959. 307p. \$15.00.

Recent advances in the uses of radioactive isotopes in medicine are reviewed. Both diagnostic and therapeutic applications are discussed. Other topics discussed include dosimetry, health and safety procedures, radiological protection of workers engaged in the manufacture of natural uranium fuel, an evaluation of inhalation hazards in nuclear energy industry, developments in neutron capture therapy, radioinduced tumors, radiostrontium metabolism and decontamination in man,

the detection of strontium-90 and cesium-137 in the human, new developments in radiation protection and recovery, the treatment and prophylaxis of radiation disease with leukocyte and thrombocyte masses, and biological and medical studies with high energy particle accelerators. Papers are included from a symposium on progress in teletherapy. (C.H.)

12418**RADIATION PRESERVATION OF FOOD.** S. D.

Balley, J. M. Davies, B. H. Morgan, R. Pomerantz, R. G. H. Siu, and R. G. Tischer, eds. Washington, D. C., U. S. Army Quartermaster Corps, 1957. 469p. \$5.00(OTS)

Developments in the field of radiation preservation of food are summarized. The history of food preservation is reviewed and social implications of radiation preservation are discussed. The physical, chemical, and biological effects of radiation on food are discussed in detail. Technological problems and recent advances are reviewed. Future developments are predicted. A complete subject index is included. (C.H.)

12419

BASIC MECHANISMS IN RADIOBIOLOGY. II. PHYSICAL AND CHEMICAL ASPECTS. Proceedings of an Informal Conference Held at Highland Park, Illinois, May 7-9, 1953. NAS-NRC Pub. 305. John L. Magee, Martin D. Kamen, and Robert L. Platzman, eds. Washington, D. C., National Academy of Sciences-National Research Council, 1953. 150p.

The nature of the mechanisms involved in the early stages of the interaction of radiation and biological systems was discussed at this conference. Topics discussed include the initial energy transfer from incident radiation to matter, energy transfer from secondary electrons to matter, mechanisms of energy degradation and chemical change, the effects of secondary electrons, mechanisms of energy degradation and chemical change, the effects of electronic excitation, and the importance of radiation chemical effects in radiobiology. (C.H.)

12420

RESEARCH IN RADIOLOGY. Proceedings of an Informal Conference, Highland Park, Illinois, May 10-12, 1957. Nuclear Science Series Report Number 22. NAS-NRC Pub. 571. Henry S. Kaplan, ed. Washington, D. C., National Academy of Sciences-National Research Council, 1958. 218p. \$1.75.

The purpose of this conference was to bring together experimental radiobiologists and clinical radiotherapists for mutual exchange of information, attitudes, approaches, and problems and to explore the feasibility of biometrically designed controlled clinical trials in radiotherapy. Topics discussed include factors determining the radiosensitivity of cells, factors in the host and tumor bed affecting radiosensitivity, factors related to the agent and the mode of treatment in radiotherapy, and the possibilities of a national experiment to evaluate supervoltage therapy. (C.H.)

CHEMISTRY**General****12421** AAEC/E-13

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales. A RAPID ROUTINE METHOD FOR THE DETERMINA-

TION OF SUB-MICROGRAM AND MICROGRAM AMOUNTS OF BERYLLIUM IN FILTER PAPER. T. M. Forence. Oct. 1958. 7p.

A rapid routine method for the determination of sub-microgram and microgram amounts of beryllium in filter paper smears is presented. Beryllium is determined fluorometrically with 3:5:7:2:4'-pentahydroxyflavone (MORIN). Many interfering elements are removed by adsorption on a strongly basic anion-exchange resin from 9M hydrochloric acid. (auth)

12422 AECD-4279

Massachusetts Inst. of Tech., Oak Ridge, Tenn.

Engineering Practice School.

A NEW SYSTEM FOR CATALYTIC RECOMBINATION OF HYDROGEN AND OXYGEN. F. D. Miraldi, C. J. Billerbeck, W. S. Delicate, and J. Farquhar, III. Oct. 8, 1954. Decl. Apr. 17, 1959. 20p. For Carbide and Carbon Chemicals Co. [K-25 Plant. Contract W-7405-eng-26, Subcontract 70]. (KT-187). \$3.30(ph), \$2.40(mf) OTS.

The operational characteristics of a tube recombiner for hydrogen and oxygen in which the gases are passed over stainless steel tubes coated with platinum black were investigated. The effects of varying the flowrates of both the reaction mixture and coolant steam were studied in particular, while maintaining a constant inlet temperature of approximately 275°F and a constant inlet steam composition of 5% oxygen, 5% hydrogen, and 90% steam. Test results are included. (J.R.D.)

12423 AECD-4280

Los Alamos Scientific Lab., N. Mex.

A METHOD FOR THE ANALYSIS OF HYDROGEN IN URANIUM. J[ames] T. Waber and E. S. Wright. [1955?]. Decl. Jan. 30, 1956. 9p. Contract [W-7405-eng-36]. \$1.80(ph), \$1.80(mf) OTS.

The hydrogen is extracted from the hot uranium metal by pumping. The sample is held in a vacuum, approximately 10^{-6} mm Hg, prior to heating to 500°C. The gas which evolves at temperature is transferred by an automatic Toepler pump into a small calibrated volume and the pressure read with a precision cathetometer. A small virtual leak in the vacuum system contributes a blank, which is proportional to the duration of the extraction. The content is computed by the ideal gas law from the known pressure, temperature, and volume. (auth)

12424 AECD-4282

Los Alamos Scientific Lab., N. Mex.

THE DETERMINATION OF THORIUM IN THE PRESENCE OF URANIUM, TITANIUM AND TUNGSTEN. Hobart H. Willard, Arthur W. Mosen, and Ross D. Gardner. [1956?]. Decl. Dec. 5, 1956. 10p. Contract W-7405-eng-36. \$1.80(ph), \$1.80(mf) OTS.

Thorium is separated from uranium, titanium, and tungsten by precipitation as fluoride. The precipitate is ignited to oxide, dissolved in nitric acid, evaporated with perchloric acid, neutralized to a pH between 2.0 and 2.5, and titrated with the disodium salt of ethylenediamine tetraacetic acid, using Eriochrome Cyanine as indicator. If less than 30 mg of thorium is present, lanthanum is added as a carrier. (auth)

12425 AERE-C/M-377

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF OXYGEN AND HYDROGEN IN HELIUM. W. R. Marsh. Mar. 1959. 16p. \$0.33 (BIS).

A method is described for the determination of oxygen and hydrogen in helium. Both determinations are based on the use of a simple galvanic cell which is sensitive to oxygen in the gas phase. The relationship between oxygen concentration and cell current is linear up to concentrations of about 150 ppm., but at higher concentrations deviation from linearity occurs. Hydrogen is analyzed by catalytic combination with an excess of oxygen added electrolytically, followed by galvanic determination of the residual oxygen. The method has been used up to oxygen and hydrogen concentrations of 1%. (auth)

12426 ANL-5991

Argonne National Lab., Lemont, Ill.

VAN SLYKE FACTORS FOR HYDROGEN, OXYGEN, CARBON DIOXIDE, AND CARBON MONOXIDE. G. E. Adams and A. R. Anderson. Apr. 1959. 7p. Contract W-31-109-eng-38. \$0.50(OTS).

Tables of data calculated on an IBM 610 automatic computer are given to convert the measured pressure differences in the Van Slyke gas analysis apparatus into micromolar concentration of gas in solution for hydrogen, oxygen, carbon dioxide and carbon monoxide in water. Measured solubility coefficients for carbon dioxide in various aqueous solutions of formic acid are given together with the conversion factors for use with the Van Slyke analysis apparatus. (auth)

12427 BR-210

Imperial Chemical Industries, Ltd. General Chemical Group, Widnes, Lancs, England.

NOTES ON THE DEVELOPMENT OF THE FLUORINE CELL, MAY 1939—AUGUST 1940. A. J. Rudge. Apr. 2, 1941. 20p.

Details of work done on the development of a low-temperature fluorine cell are given. The operation of such a cell is described together with modifications which have been carried out. The design of a larger cell is also discussed, and current problems are examined. (J.R.D.)

12428 CEI-40

National Research Council of Canada. Atomic Energy Project, Chalk River, Ont.

A SURVEY OF LIQUID-LIQUID CONTACTING EQUIPMENT. S. H. Russell. Feb. 15, 1952. 17p.

A literature survey of liquid-liquid extraction equipment presently in use is presented. The apparatus is considered from the point of view of its usefulness and capabilities when applied to primary separation processes. The major classification is determined by whether gravity or centrifugal force is used to separate the phases. Extractors are considered separately from the standpoints of design, operation, and maintenance. (J.R.D.)

12429 CEI-48

Atomic Energy of Canada Ltd. Chalk River, Project, Chalk River, Ont.

ENTRAINMENT AND EFFICIENCY STUDIES IN A SMALL DIAMETER BUBBLECAP PLATE COLUMN. J. Chrones. July 2, 1952. 37p.

Efficiency and entrainment studies were made in a 4-inch diameter bubblecap plate column using a plate spacing of 4 inches. The plates contained one bubblecap each, and were designed so that they could be easily inserted in a single length of 4 inch OD stainless steel tubing. An entrainment of 10% was obtained for the water-steam system at a column vapor velocity of 1.9 fps or a vapor mass rate of 255 pounds of steam per hour per square foot. This entrainment value is gener-

ally accepted as the maximum allowable without impairing the plate efficiency appreciably. This low entrainment may be partly due to the small column diameter with the walls acting as entrainment separators. The Murphree vapor plate efficiency, as measured for alcohol-water, was found to depend on the slope of the equilibrium line and the mass velocity factor $Vg_v^{0.5}$. An empirical equation was developed relating these factors. For low values of the slope of the equilibrium line (2 or less it was noted, that for practical purposes, the actual point efficiency on the plates was equal to the measured Murphree vapor plate efficiency regardless of the degree of mixing on the plate. (auth)

12430 HW-58587

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

THE PILOT PLANT DENITRATION OF PUREX WASTES WITH FORMALDEHYDE. T. F. Evans. Feb. 23, 1959. 32p. Contract W-31-109-Eng-52. \$1.00(OTS).

The reaction between formaldehyde and nitric acid, in which the acid is destroyed with the production of predominantly gaseous products, has been recognized as of great potential value in the processing of radioactive fuels, particularly during waste treatment. Laboratory studies of the reaction at Harwell and at Hanford have shown that a major fraction of the nitric acid can be readily removed from an acidic solution containing nitrates by the addition of formaldehyde. The process possesses the advantages of low chemical cost; recoverability of nitric acid; and, in the case of waste treatment, the production of a solution relatively low in inert salt concentration suitable for fission product recovery or ultimate disposal. The primary purpose of the study was to confirm and extend existing information on the formaldehyde reaction to the destruction of nitric acid in Purex type waste (1WW) through operation of pilot plant scale apparatus. Operational behavior, formaldehyde utilization efficiency, and safety considerations were particular subjects of study. In addition, destruction of nitric acid in a Darex-type dissolver solution was investigated. (auth)

12431 HW-59032

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

AN ANALYTICAL METHOD FOR NEPTUNIUM-237 USING ANION EXCHANGE. F. P. Roberts. Jan. 28, 1959. 14p. Contract W-31-109-Eng-52. \$0.50(OTS).

A method was developed for separation of neptunium from plutonium, uranium, americium, curium, and fission products by anion exchange with sufficient decontamination to permit neptunium-237 estimation by alpha energy analysis and neptunium-239 estimation by gamma spectrometry. The sample is spiked with neptunium-239 tracer to permit yield corrections and loaded on a small column of Dowex 1, X-4 (100-200 mesh) from 8 M nitric acid in the presence of ferrous sulfamate and semicarbazide. After washing the resin with 30 to 40 column volumes of a 4.5 M nitric acid solution containing ferrous sulfamate and semicarbazide, the neptunium is eluted with 0.005 M ceric sulfate in dilute nitric acid and mounted for total alpha counting, alpha energy analysis, and gamma energy analysis. Neptunium recoveries of 95% have been obtained while plutonium decontamination factors are 5×10^4 . Decontamination factors for uranium, americium, curium, and gross fission products are all greater than 10^4 . Uranium, up to 180 g/l in the column feed, does not interfere. The plutonium decontamination factor can be increased by a factor of 10 to 100 by fol-

lowing the nitric acid-ferrous sulfamate-semicarbazide wash by a wash with 0.1 M NH_4I in 12 M HCl. This is followed by neptunium elution with 6.5 M HCl containing 0.004 M HF. The method is applicable to the high salt samples from the Redox process as well as Purex process samples. (auth)

12432 HW-59642

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

THE SPECIFIC ACTIVITY AND HALF-LIFE OF Np^{237} . F. P. Brauer, R. W. Stromatt, J. D. Ludwick, F. P. Roberts, and W. L. Lyon. Mar. 13, 1959. 6p. Contract W-31-109-Eng-52. \$1.80(ph), \$1.80(mf) OTS.

The Np^{237} specific activity has been determined to be 1562 ± 7 disintegrations per minute per microgram which corresponds to a half-life value of $2.14 \pm 0.01 \times 10^6$ years. The previously reported value was $2.2 \pm 0.1 \times 10^6$ years. The new value was obtained by the absolute alpha counting of known amounts of Np^{237} using both low geometry proportional counting and 4π liquid scintillation counting. The samples of Np^{237} counted were taken from a standard solution prepared from neptunium metal and checked by coulometric titration. The specific activity of Np^{237} was determined by the absolute alpha counting of known amounts of Np^{237} using both low geometry proportional counting and 4π liquid scintillation counting. The aliquots of Np^{237} were taken from a standard solution prepared from neptunium metal and checked by controlled potential coulometric titration. The observed alpha disintegration rate was corrected for the contribution of the plutonium impurity as determined by alpha energy analysis. The neptunium used was analyzed isotopically to insure that isotopes other than Np^{237} were present at a sufficiently low concentration to be neglected. The standardizations and other experimental details are discussed in the following sections. (auth)

12433 ISC-1069

Ames Lab., Ames, Iowa.

SEPARATION OF CERIUM FROM OTHER RARE EARTHS BY IGNITION OF THE NITRATES. Russell W. Johnson and Edwin H. Olson. Sept. 1958. 33p. Contract W-7405-eng-82. \$1.00(OTS).

Cerium was separated from the light rare earths by ignition of the nitrates whereby the cerous nitrate was decomposed to ceric oxide. Small scale investigations were made using sodium nitrate and magnesium nitrate hexahydrate as fluxes. A cost estimate based on data from the small scale investigations showed the sodium nitrate ignition to be more economical; therefore, bench scale investigations were made using sodium nitrate. With a weight ratio of sodium nitrate to rare earth nitrate hexahydrate of 1:2 and a temperature of approximately 295°C for 12 to 16 hours, a nearly quantitative conversion of cerous nitrate to ceric oxide was obtained. The ceric oxide obtained upon dissolving the soluble sodium nitrate and undecomposed rare earth nitrates and filtering, using Celite filtering aid as a precoat, was found to be quite pure. Indications are that an even purer ceric oxide could possibly be obtained if a lower temperature for a longer length of time had been used. (auth)

12434 KAPL-M-FPL-2

Knolls Atomic Power Lab., Schenectady, N. Y.

ORGANIC MATERIAL IN S3G/S4G BOILER WATER: INFRARED DETERMINATION OF OIL IN WATER.

F. P. Landis. Apr. 15, 1959. 20p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

The results obtained from analysis by gravimetric and infrared techniques of water samples from S4G are discussed. The methods are compared, and organic sample separation and qualitative tests are examined. The recoveries of the added oil indicate an over-all reproducibility of about four percent for the infrared analysis. (J.R.D.)

12435 LA-1950

Los Alamos Scientific Lab., N. Mex.

THE ANALYSIS OF LITHIUM ARSENIDE. E. H. Van Kooten, A. W. Mosen, and G. R. Waterbury. May 1955. 17p. Contract [W-7405-eng-36]. \$3.30(ph), \$2.40(mf) OTS.

A method is described for the quantitative determination of lithium and arsenic in lithium arsenide. The sample is treated with distilled water in a special apparatus, the arsine formed is absorbed in bromine water, and the lithium in the residual aqueous solution is determined by titration with standard acid. The entire sample is then combined, the excess bromine is boiled off, and hydrazine hydrochloride and potassium bromide are added. The arsenic is distilled as arsenic trichloride after the solution has been made approximately 6N in hydrochloric acid, and the arsenic is determined by potentiometric titration with standard potassium bromate solution. An average recovery of 100.1%, with a standard deviation 0.1%, was obtained for 32 determinations of 17.86 milligrams of lithium in the presence of 11 to 100 mg of arsenious oxide. An average recovery of 100.0%, with a standard deviation of 0.6%, was obtained for 21 determinations of 17 to 155 milligrams of arsenic; the method is less reliable for smaller quantities of arsenic. (auth)

12436 LA-2291

Los Alamos Scientific Lab., N. Mex.

THE PREPARATION OF HIGH-PURITY PLUTONIUM DIOXIDE AND PLUTONIUM(III) CHLORIDE SOLUTION. James E. Rein, Arthur L. Langhorst, Jr., and Maxine C. Elliott. Jan. 12, 1953. [Issued] Apr. 3, 1959. 25p. Contract W-7405-eng-36. \$1.00(OTS).

A method is described for the preparation of high-purity PuO_2 . The purification process consists of a partial removal of impurities by electrolysis into a Hg cathode and a subsequent further purification by precipitation of the Pu as the peroxide. The peroxide precipitate is ignited to the dioxide at 900°C in a platinum-lined furnace under noncontaminating conditions. The product contained about 2 ppm Mn as the only detectable metal impurity exceeding 1 ppm. This high quality is readily reproduced batchwise. The preparation of a high-purity Pu(III) chloride solution is readily achieved by dissolving the above-mentioned peroxide in quartz-distilled HCl. (auth)

12437 LS-6

Israel. Atomic Energy Commission, Tel-Aviv.

LITERATURE SURVEY ON: 1. THE CHEMISTRY OF ACTINIUM AND PROTACTINIUM—ESPECIALLY IN AQUEOUS SOLUTIONS. 2. DETERMINATION OF ACTINIUM AND PROTACTINIUM. 3. TECHNICAL INFORMATION ON RADIUM INDUSTRY RESIDUES. Sept. 1958. 34p.

This survey includes 250 references from the report and published literature on the subjects of interest. Sources considered included bibliographies, books, and reports in the library of the Israel Atomic Energy Commission. Also, Analytical Abstracts, Jan. 1954 to

July 1958, Nuclear Science Abstracts, Jan. 1948 to June 15, 1958, and Chemical Abstracts, Jan. 1921 to July 25, 1958, were consulted. (L.T.W.)

12438 NP-7397

Mine Safety Appliances Co., Callery, Penna.

NaK AS A THIRD FLUID IN A SODIUM-WATER SYSTEM. Memo Report 75. R. C. Werner. Jan. 19, 1955. 10p. Contract NObs-65426.

The hazards involved if a leak should develop between NaK as a third fluid and water or sodium in a steam generator or superheater are discussed. If NaK were to leak into the water, the water would dissolve the hydroxides formed. The steam would act as a blanket to reduce any pressure waves and would sweep the hydrogen formed to the condenser. If water were to leak into the NaK third fluid system, the reduction in pressure initially and being closer to the heating sodium stream, the water would become steam thus greatly reducing any pressure wave formations. If NaK were to leak into the sodium system there would be a change in the nuclear operation of the unit and possibility of sludge formation by changing the primary stream from sodium to NaK thus lowering the solubility ability of the fluid. (auth)

12439 NP-7418

Mine Safety Appliances Co., Callery, Penna.

REMOVAL OF MERCURY IN RESIDUAL SODIUM FROM A DRAINED SYSTEM USING A SODIUM FLUSH. Memo Report 103. E. F. Batutis, C. A. Palladino, and K. F. Barker. Jan. 17, 1956. 9p. Contract NObs-65426.

The use of a fresh sodium charge to dilute mercury in the residual sodium of a drained system is a practical method for eventually removing the mercury. This was confirmed by using a hold-up pocket filled with a sodium amalgam and circulating fresh sodium past the $\frac{1}{2}$ in. pocket opening. The sodium amalgam in the bottom of the pocket was more effectively diluted by raising the system temperature to 600°F. The major portion of the mercury, in the pocket, mixed with the flush sodium circulating at 2.5 fps, at any temperature from 350 to 600°F in 15 to 30 minutes. (auth)

12440 NP-7426

Mine Safety Appliances Co., Callery, Penna.

PLUGGING LEAKS BETWEEN WATER AND THIRD FLUID SYSTEM (NaK). Memo Report 117. S. J. Rodgers and J. W. Mausteller. Aug. 21, 1956. 11p. Contract NObs-65426.

An investigation was made to find a NaK additive which could be used to seal NaK-water leaks in systems such as the S2C evaporator and superheater. A mixture of 1 wt. % Fe_3O_4 and 0.2 wt. % asbestos plugged a leak of 0.3 liter NaK/hr, but only partially plugged a 1.0 liter NaK/hr leak. The leak was completely plugged when operated in the vapor phase, but the seal failed when the leak area was exposed to water. The seal formed in the 0.3 liter NaK/hr leak held at a ΔP of 560 psi for 1 hr and at a ΔP of 250 psi overnight. An Fe_3O_4 -asbestos mixture can be used as a sealant but will have limited applications. (auth)

12441 ORNL-2673

Oak Ridge National Lab., Tenn.

THOREX PILOT PLANT CORROSION STUDIES: I. CORROSION OF TYPES 304L AND 309Scb STAINLESS STEEL DURING PRODUCTION AND DEVELOPMENT PERIODS. J. L. English. May 12, 1959. 73p. Contract W-7405-eng-26. \$2.25(OTS).

The corrosion behavior of types 304L and 309Scb

stainless steel was examined during the production and first half of the development periods of Thorex pilot plant operation between December 15, 1954, and November 10, 1955. The process vessels in which corrosion data were obtained included the batch dissolver tank, the feed adjustment tank, the AP catch tank, and the BT vapor separator. There was no significant difference between the corrosion resistance of the two alloys in any of the environments. Vapor-phase corrosion attack in some vessels was more severe than solution-phase attack in the same vessels. Dependent upon the particular process environment, corrosion rates in the vapor phase ranged from 0.1 to 46 mpy; solution-phase corrosion rates ranged from 0.1 to 28 mpy. The most severe attack in both solution and vapor phases occurred in the feed adjustment tank. There was serious corrosion in the BT vapor separator also. Corrosion was moderate (8 mpy or less) in the batch dissolver tank and was almost negligible (0.2 mpy or less) in the AP catch tank. The attack on rolled surfaces of both types of stainless steel was uniform, with the exception that shallow, intergranular penetration was experienced in the more corrosive environments. Edge-surface attack was intense in the latter environments also and introduced some question as to the validity of corrosion rates based upon total attack on specimens. Neither of the alloys, initially stressed at 35,000 psi, experienced stress-corrosion cracking in any of the environments, nor was there any evidence of a stress-induced acceleration in the rates of attack. Weld specimens of both alloys underwent preferential attack at the weld-parent metal interface in a number of the environments; the frequency of the attack was random in nature, however. Neither alloy was subject to crevice corrosion nor was accelerated corrosion at solution-vapor interfaces observed. (auth)

12442 ORNL-2678

Oak Ridge National Lab., Tenn.

TABLES OF ISOTOPE EFFECT FUNCTIONS FOR HOMOCOMPETITIVE FIRST-ORDER REACTIONS. M. H. Lietzke and Clair J. Collins. May 11, 1959. 40p. Contract W-7405-eng-26. \$6.30 (ph), \$3.00 (mf) OTS.

The ORACLE has been employed to determine, for first-order irreversible reactions, the relation between fraction of reaction ($f = 1 - e^{-kt}$) and the accumulated product ratio R ($R = 1 - e^{-kt}/1 - e^{-k^*t}$) over a range of values for the isotope effect (k^*/k) of 0.05 to 0.99. These data are presented in tables and graphs. Calculations were also made for f as a function of the ratio (x) of the differentials of the fractions of labeled to unlabeled molecules formed. These latter results are presented graphically. The calculations show how the ratio of product from labeled reactant to product from unlabeled reactant varies with the isotope effect. They also illustrate several types of error which can be introduced into tracer experiments, and are useful in assisting the investigator to estimate graphically the value of the isotope effect for a given reaction knowing a) the isotopic ratio of initial reactant, b) the isotopic ratio of the product accumulated at any time t , and c) the fraction f of unlabeled material which has undergone reaction at any time t . (auth)

12443 ORNL-2689

Oak Ridge National Lab., Tenn.

AN EVALUATION OF HYDROCLONES FOR SIZE CLASSIFICATION OF THORIUM OXIDE. E. L. Youngblood and P. A. Haas. May 18, 1959. 44p. Contract W-7405-eng-26. \$1.25(OTS).

The performance of hydraulic cyclones or hydroclones was evaluated theoretically and experimentally for size classification of thorium oxide. Oversize material was removed from 1-3 μ mean diameter thorium oxide by use of commercial (modified TM-3 Dorr Clones) equipment. Batch and continuous classification were demonstrated with product rates of up to 1 kg of ThO_2 per minute and removal of over 95% of material three times the mean diameter. Good agreement was obtained between experimental results and calculations from literature correlations. Dispersion was not complete even with dispersing agents; therefore, effective removal of undersize ThO_2 was not practical. The advantages of hydroclones are that they require no dispersing agents and have an ability to classify below 7- μ material, as compared with hydraulic classification by sedimentation and air classification, respectively. (auth)

12444 RDB(R)/TN-1

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

THE CALCULATION OF THE VISCOSITY OF LIQUID METALS (WITH SPECIAL REFERENCE TO LITHIUM). E. S. Smith. Jan. 1952. 11p.

Results indicate that the relationship between the viscosity and temperature for liquid metals is of a type similar to that suggested for liquids in general. The viscosity of lithium at its melting point was calculated to be 0.006 poises, and the variation of viscosity of molten lithium with temperature was estimated. An equation for the summation of fluidities was found to give good results when applied to the calculations of the viscosity of K-Na alloys from the known viscosities of the compounds. There is apparently a connection between the viscosity of the liquid metal and its position in the Periodic Table. (auth)

12445 TID-7568(Pt. 1)

Oak Ridge National Lab., Tenn.

ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. C. D. Susano, H. P. House, and Margaret A. Marler, eds. 305p. \$3.00 (OTS).

The papers presented at the conference covered the following subjects; status of analytical chemistry in certain specific reactor operation and research activities, boron and special analyses, analysis of fuel materials, applications of flame photometry and polarography, and applications of x-ray and emission spectroscopy. Separate abstracts have been prepared for each paper. (W.L.H.)

12446 TID-7568(Pt. 1)(p.3-8)

Argonne National Lab., Lemont, Ill.

ANALYSIS OF REACTOR ALLOYS. R. W. Bane. p.3-8 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 6p.

Methods used to analyze metals and alloys during basic metallurgical investigations of new alloys and the development of more efficient reactor fuel elements are discussed. Chemical procedures are briefly described for the determination of Zr, Ni, Pb, Bi, Sb, V, B, Th, Be, Mn, Ru, Sn, Mo, Fe, and Ga in binary and ternary U alloys. Emphasis is placed upon the analysis of those alloys used in operating reactors or reactors under

construction such as EBWR and ALPR. Examples of this type of analysis are (1) the gravimetric method used for the determination of Zr and Nb during the research phase of EBWR and (2) the rapid direct spectrographic procedure used to verify specifications during assembly. Analytical procedures for the determination of C, H, and O in U, Pu, and their alloys are indicated. (auth)

12447 TID-7568(Pt. 1)(p.9-19)

Argonne National Lab., Lemont, Ill.
THE SPECTROPHOTOMETRIC DETERMINATION OF ZIRCONIUM, MOLYBDENUM, RUTHENIUM, PALLADIUM, AND CERIUM IN URANIUM "FISSION" ALLOYS. R. P. Larsen and L. E. Ross. p.9-19 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 11p.

After a number of fuel processing cycles in the melt refining of EBR-II fuel in oxide crucibles, U alloy is produced which contains more than one per cent each of Zr, Mo, Ru, and Pd and about 0.5 per cent of Nb and Rh. Although rare-earth elements are effectively removed in this process, each pass through the reactor will bring their combined concentration in the discharge fuel to about 0.5 per cent. Inactive U alloys of these fission elements have been prepared with Ce as a stand-in for all the rare-earth elements and used in the development of processing methods. It was necessary to devise analytical methods capable of determining as little as 0.1 per cent Mo, Ru; and Pd and 0.01 per cent Zr and Ce in these alloys with each of the other fission elements at the 1 per cent level. The method for Ce, which is based on the color of the ceric tartrate complex in ammoniacal solution, is completely new. The method for Zr is an extensive revision of alizarin red S methods found in the literature. The method for Ru, which has been completely revised, is based on the color of the RuO_4^- in a basic OCl^- medium. Literature methods, to which necessary separation steps have been added, are used for the determination of Mo and Pd. These methods will be used in the EBR-II analytical facility now being constructed in Idaho. (auth)

12448 TID-7568(Pt. 1)(p.20-3)

Knolls Atomic Power Lab., Schenectady, N. Y.
THE RAPID ANALYSIS OF DISSOLVED GAS IN HIGH-PRESSURE COOLANT WATER. E. L. Shirley. p.20-3 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 4p.

High-pressure water coolant loops are conventionally operated with an excess of dissolved hydrogen to minimize the effect of oxygen corrosion. Since this dissolved hydrogen is depleted by recombination with oxygen and leakage from the system, periodic additions of hydrogen must be governed by control analysis. A simple, rapid method for the determination of dissolved gas was sought for use by the operating crew. The method described was developed from observations of the appreciable expansion of water samples from these loops which had been collected in high-pressure bombs. The volume of the total dissolved gas in a water sample is calculated from a measurement of the expansion of the high-pressure system when it is reduced to atmospheric pressure. A known volume of air is then equilibrated

with the expanded system, and the dissolved hydrogen content of the original water sample is calculated from thermal conductivity measurements of this equilibrated air. (auth)

12449 TID-7568(Pt. 1)(p.24-35)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ANALYSIS IN REACTOR RESEARCH AT HARWELL. G. W. C. Milner. p.24-35 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 12p.

Basic metallurgical studies on solid fuel elements have required the chemical analysis of many uranium-, thorium- and plutonium-base alloys. Zirconium, niobium, and tantalum have been used as constituents of several uranium-base alloys, and improvements in the procedures for the determination of these constituents are described. Ethylenediaminetetraacetic acid has been applied widely both as a volumetric reagent and as a masking agent, especially in the analysis of thorium-base alloys. The available methods for many binary thorium alloys are described. In plutonium alloy analysis, Deacidite FF has been extensively used for the preliminary separation of plutonium from other constituents before completing their determination. For the determination of the plutonium content of several systems, differential spectrophotometry has proved extremely useful and details are given. Reactor systems with liquid fuels have been studied in recent years. In basic studies of a liquid metal system, the analysis of many ternary bismuth-base alloys have been required to determine the effects of fission product elements (Ce, Nd, Pr, etc.) on the solubility of uranium in bismuth. Ion-exchange and solvent-extraction procedures have been utilized for the preliminary separation of the bismuth. Similar techniques have been used for the separation of lead in limited work on a system in which this metal is used. In studies of a reactor system using aqueous uranyl sulfate fuels, methods have been developed for the determination of the uranium and copper contents of active and inactive solutions. These methods are described, together with those for the determination of the iron, chromium, and nickel contamination resulting from the stainless steel containers and loops. (auth)

12450 TID-7568(Pt. 1)(p.36-49)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

CHEMICAL CONTROL OF PRESSURIZED-WATER TEST LOOPS AND AUTOCLAVES. B. D. La Mont, J. V. Derby, C. A. Meinz, and J. D. Johnson. p.36-49 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 14p.

This paper is essentially the same as WCAP-964.

In the study of the effects of fluid poisons such as boric acid or alkali borates in pressurized-water reactors, careful chemical control of the experimental environment is required. Autoclaves or dynamic test loops are used in this program. Small samples (approximately 10 ml) of the test solution are collected at operating conditions (2000 psi; 600°F) by a by-pass sampling system. Gas chromatography is used to de-

termine dissolved hydrogen. The alkali elements—lithium, sodium, or potassium, are measured by flame photometry, using spectral energy recording attachments on a Beckman Model DU Spectrophotometer. Boron is determined titrimetrically, or by flame photometry, depending on the concentration range. Chloride and dissolved oxygen are measured spectrophotometrically. Corrosion products are determined by emission and x-ray spectrography. (auth)

12451 TID-7568(Pt. 1)(p.50-74)

Lockheed Aircraft Corp., Marietta, Ga.

ANALYTICAL REQUIREMENTS ON THE LOCKHEED CRITICAL EXPERIMENT REACTOR, OF THE RADIATION EFFECTS REACTOR, AND OF THE RADIO-ACTIVE-WASTE DISPOSAL SYSTEM. J. H. Edgerton. p.50-74 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 25p.

The analytical chemistry requirements of the Lockheed Critical Experiment Reactor, Radiation Effects Reactor and the Radioactive Waste Disposal System are discussed. The Critical Experiment Reactor is a low-power reactor of the swimming-pool type which is operated in a pool of deionized water. The Radiation Effects Reactor is a 10-megawatt, heterogeneous, pressurized, water-type reactor, cooled and moderated with light water. In this paper are described the use of process instrumentation and the application of the methods of analytical chemistry for maintaining proper conditions for operating the reactors. Methods for the analysis of reactor materials including corrosion, activation, and fission products are discussed. The radioactive waste disposal system for normal and abnormal operation of the reactor is described. The problem of detecting fuel elements which fail is also discussed. (auth)

12452 TID-7568(Pt. 1)(p.77-86)

Oak Ridge National Lab., Tenn.

THE VOLUMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF BORON. Hisashi Kubota. p.77-86 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 10p.

The titration of a complex of boron with a polyhydroxy alcohol is a time-tested method for the determination of milligram or larger quantities of boron, while the colorimetric curcumin method is a very sensitive procedure for the determination of 0.1 to 2 μg of boron. It is desirable to have a method that will bridge the gap between the two methods, namely, one that is useful for determining 10 to 100 μg of boron. Since the equivalent weight of boron is small, the extension of the lower limit of the titrimetric procedure was investigated, and the results are reported. The various factors that affect the end points in the titration of the free acid and borate-alcohol complex are discussed. The precision, expressed as the coefficient of variation, is about 5 per cent in the 10- to 20- μg range and approaches 2 per cent at the 100- μg level. (auth)

12453 TID-7568(Pt. 1)(p.87-95)

Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.

COLORIMETRIC DETERMINATION OF BORON:

STUDY OF VARIABLES INVOLVED IN THE QUINALIZARIN METHOD. J. E. Kelly. p.87-95 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 9p.

The spectrophotometric method for the determination of boron with quinalizarin was investigated and was found to suffer from the following three distinct, inherent disadvantages: (1) Beer's law is not adhered to due to complex formation being favored at the higher quinalizarin concentrations; hence the range is restricted. (2) An inverse relation exists between the range and the sensitivity of the method which is a function of quinalizarin concentration, and therefore conditions must be chosen with this limitation in mind. (3) An unfavorable similarity between the quinalizarin and quinalizarin-boron spectra imposes a further limitation on the sensitivity. The effects of temperature, time, and acid concentration on the reaction are shown by data obtained in this study. Ringbom plots are used to illustrate the effect of varying the conditions as well as to establish optimum conditions which are dependent on the application for which the method is to be used. Regular, symmetrical acid concentration-transmittance curves representing the behavior of the boron-quinalizarin system as predicted from consideration of Ringbom plots have been obtained. The need for strict temperature control is emphasized. The role of acid concentration in the light of the contributions of other workers, particularly those of Toogood and Johnson, is discussed. (auth)

12454 TID-7568(Pt. 1)(p.96-100)

Georgia. Univ., Athens.

THE ANALYTICAL APPLICATIONS OF ETHYLENE-DIAMINETETRAACETIC ACID AND ITS SALTS. T. H. Whitehead. p.96-100 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 5p.

Since 1945, when Schwarzenbach published his first paper on EDTA, over a thousand articles have been published on the analytical applications of this reagent. Obviously, EDTA is a very versatile and useful reagent in analytical chemistry, since it has been applied to the determination of almost every cation and many anions. It is unique in that it forms stable complexes with metallic cations in a 1:1 ratio, regardless of the charge on the metallic ion. This is possible because it can occupy two, four, or six coordinate positions in the atomic shell of ions. It can dissociate step-1 wise from H_4A to A^{4-} , but its usual form is the disodium salt, $\text{Na}_2\text{H}_2\text{A}$. The equilibria involving EDTA are controlled to a large extent by the pH of the solution in which it is used. It may be used (1) as a direct titrant in volumetric analysis, (2) as a back-titrant in volumetric analyses, (3) as a masking agent in gravimetric work, (4) in acid-base titrations, and (5) as an agent for cation replacement. Visual indicators which are colored, complex formers are available for use with EDTA in titrations. Their usefulness depends upon their relative tenacity as complexing agents and the pH of the solution. This paper discusses the chemical equilibria involved in the use of EDTA and its applications to the determination of Be, Co, Hf, Pb, Ra, Pt, Ta, Th, Ti, and U. (auth)

12455 TID-7568(Pt. 1)(p.101-4)

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

DETERMINATION OF DEUTERIUM, OXYGEN, AND NITROGEN IN HELIUM BY GAS CHROMATOGRAPHY. David L. West. p.101-4 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 4p.

Helium is used as a blanket gas in many nuclear reactors. It is often contaminated with air during the work preceding reactor startup and it may become contaminated with moderator decomposition products during subsequent operation of the reactor. This paper describes a gas chromatographic method that was developed at the Savannah River Laboratory for the determination of deuterium, oxygen, and nitrogen in helium. The method is applicable to samples containing as little as 0.02 mol per cent deuterium, 0.005 mol per cent oxygen, and 0.02 mol per cent nitrogen. Typical relative standard deviations are: for 3.4 mol per cent deuterium, 5 per cent; for 0.3 mol per cent oxygen, 3 per cent; and for 1.0 mol per cent nitrogen, 2 per cent. This method is rapid and economical and it can be used to monitor helium blanket gas on a routine basis. (auth)

12456 TID-7568(Pt. 1)(p.105-12)

Oak Ridge National Lab., Tenn.

THE SPECTROPHOTOMETRIC DETERMINATION OF CERIUM IN FLUORIDE SALTS. J. C. White and R. F. Apple. p.105-12 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 8p.

Cerium(III) in fluoride salt mixtures can be determined by measurement of its ultraviolet absorption peak at 253 m μ in 3 M HCl. Over the range of 0 to 0.2 mg of Ce per milliliter, Beer's law is obeyed; a Ringbom plot indicates that the optimum range is 0.02 to 0.12 mg/ml. The interfering ions, Fe(III), Cr(VI), and U(VI), are removed by extraction from a 6 M HCl solution into a cyclohexane solution of tri-n-octylphosphine oxide. The method is rapid and precise and avoids difficulties which are encountered because of the instability of solutions which contain Ce(IV). (auth)

12457 TID-7568(Pt. 1)(p.117-23)

Mallinckrodt Chemical Works, St. Charles, Mo.

APPLICATION OF THE LEAD REDUCTOR TO THE DETERMINATION OF URANIUM. B. A. Swinehart. p.117-23 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 7p.

In view of some of the difficulties and inconveniences associated with the use of the Jones reductor in procedures for the determination of U, a method utilizing the lead reductor has been investigated. A purified solution of U in dilute H₂SO₄ is made 3 N with respect to HCl and passed through a column of granular lead. The resulting U(IV) solution is then titrated with a standard Ce(SO₄)₂ solution. The Ce(SO₄)₂ solution is standardized against As₂O₃, using 1,10-phenanthroline-ferrous sulfate (Ferrouin) as indicator and OsO₄ in H₂SO₄ as an oxidation catalyst, as well as against U₂O₅, using Ferrouin as the indicator. In addition, the effect of varying amounts

of U on the apparent normality of the Ce solution was determined. The completeness of reduction of U(VI) to U(IV) at different flow rates through the reductor was investigated, and the allowable time interval between reduction and titration was determined. (auth)

12458 TID-7568(Pt. 1)(p.124-34)

Ames Lab., Ames, Iowa.

COLORIMETRIC URANIUM DETERMINATION WITH ARSENAZO. J. S. Fritz and Marlene J. Richard. p.124-34 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 11p.

A rapid and sensitive method is described for the colorimetric determination of uranium(VI). Masking agents such as EDTA, tartaric acid or thio glycerol make possible the determination of uranium in the presence of many foreign cations. If thorium is present, a preliminary extraction of uranium as the diethyldithiocarbamate is required. (auth)

12459 TID-7568(Pt. 1)(p.135-9)

National Lead Co. of Ohio, Cincinnati.

DETERMINATION OF MICROGRAM CONCENTRATIONS OF ZIRCONIUM IN ORGANIC AND AQUEOUS SOLUTIONS CONTAINING URANIUM. Paul G. Laux and Ernest A. Brown. p.135-9 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 5p.

A study was made of the methods for the separation and determination of microgram quantities of zirconium from organic and aqueous solutions containing uranium. A zirconium-95 tracer was used to evaluate the stripping of zirconium from tributyl phosphate-kerosene solutions into an aqueous solution. Oxalic acid, EDTA, and hydrofluoric acid were found to be effective in quantitatively removing zirconium from the organic phase. A recommended procedure is described for the determination of zirconium based upon the use of hydrofluoric acid as a stripping agent and subsequent determination of zirconium by the alizarin red S method. A study was also made of the methods for the determination of zirconium in aqueous uranyl nitrate solutions having a high uranium to zirconium ratio. Extraction of zirconium with p-(p-dimethylaminophenylazo) benzene arsonic acid was not found to be satisfactory. Preliminary separation of uranium with trisooctylamine from a 4 M hydrochloric acid medium was found to give a quantitative separation. A recommended procedure is given, based on a trisooctylamine separation of uranium, after which the zirconium is determined by the alizarin red S colorimetric method. (auth)

12460 TID-7568(Pt. 1)(p.140-9)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

DETERMINATION OF CORROSION PRODUCTS AND ANIONS IN AQUEOUS THORIA-URANIA SLURRIES. B. D. La Mont and J. D. Johnson. p.140-9 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART I. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 10p.

Sampling and analytical procedures are given for the determination of corrosion products and anions in

thoria-urania slurries. The corrosion products include iron, chromium, nickel, titanium, copper, and cobalt. The anions measured are chloride and fluoride. Results from a typical test experiment are included. (auth)

12461 TID-7568(Pt. 1)(p.150-6)

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

DETERMINATION OF COPPER, MOLYBDENUM, SILVER, AND PALLADIUM IN AQUEOUS THORIA-URANIA SLURRIES. C. A. Meinz and B. D. La Mont. p.150-6 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 7p.

Methods are described for the determination of copper, molybdenum, palladium, and silver in thoria-urania slurries. Copper, silver, and palladium are estimated flame photometrically. Spectral energy recording attachments of a Beckman Model DU Spectrophotometer are utilized to eliminate tedious wavelength settings and to compensate more reliably for background effects. For concentration computation, peak-height recordings are compared with standards. Spectrophotometric procedures are included for the determination of copper and palladium in the lower concentration ranges. Molybdenum is determined by a spectrophotometric procedure. (auth)

12462 TID-7568(Pt. 1)(p.157-68)

Oak Ridge National Lab., Tenn.

DETERMINATION OF ALUMINUM, ZIRCONIUM, MOLYBDENUM, URANIUM, AND TITANIUM IN THORIUM OXIDE SLURRIES. Oscar Menis, T. C. Rains, D. L. Manning, Gerald Goldstein, and I. B. Rubin. p.157-68 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 12p.

Chemical methods are described for the determination of minor components (corrosion products and additives) in slurries of ThO_2 , with particular emphasis on methods for the estimation of Al, Zr, Mo, U, and Ti in the presence of each other and corrosion products of stainless steel. Procedures are discussed for the elimination of interferences by selective extractions, by separation by an ion-exchange resin column, or by masking agents. (auth)

12463 TID-7568(Pt. 1)(p.169-82)

National Lead Co. of Ohio, Cincinnati.

DETERMINATION OF THORIUM IN URANIUM ORES AND FEEDS BY SOLVENT EXTRACTION EMPLOYING THENOYLTRIFLUORO ACETONE. Paul G. Laux and Ernest A. Brown. p.169-82 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 14p.

Also issued separately as NLCO-742.

This paper was previously abstracted and appears in NSA, Vol. 12, as abstract No. 12998.

12464 TID-7568(Pt. 1)(p.183-93)

Mallinckrodt Chemical Works, St. Charles, Mo.

THE CHARACTERIZATION OF URANIC OXIDE BY A REFLECTIVITY TECHNIQUE. B. A. Swinehart. p.183-93 [of] ANALYTICAL CHEMISTRY IN NUCLEAR

REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 11p.

The color of commercial UO_3 (orange oxide) varies with its chemical composition. The presence of hydrates of UO_3 , residual $\text{UO}_2(\text{NO}_3)_2$, and the decomposition product U_2O_5 affects the color. In addition, such physical properties as particle size and type of UO_3 (as determined by x-ray analysis) alter the color. A Beckman DU spectrophotometer was adapted to the measurement of reflectivity, and a number of oxides were examined in the visible region of the spectrum. The qualitative identification of several oxides, including type III, amorphous, and the monohydrate ($\text{UO}_3 \cdot \text{H}_2\text{O}$), can be made by the use of characteristic reflectivity curves. The difference in reflectivity curves was used to develop a method for the quantitative estimation of amorphous UO_3 in the presence of type III orange oxide. In addition, an attempt was made to correlate the reflectivity data with the reactivity of orange with H to produce UO_2 and with the subsequent hydrofluorination of UF_4 . (auth)

12465 TID-7568(Pt. 1)(p.197-204)

Mallinckrodt Chemical Works, St. Charles, Mo.

THE FLAME PHOTOMETRIC DETERMINATION OF SODIUM AND CALCIUM IN URANIUM ORE CONCENTRATES. L. A. Ferguson. p.197-204 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 8p.

A Beckman Model DU quartz prism spectrophotometer equipped with a photomultiplier detector, a Spectracord recording system, and a Beckman total-consumption flame attachment is used to determine sodium and calcium in uranium ore concentrates. A study was made of interferences. Although uranium emits in the region of the sodium 589-m μ band, the sensitivity of the instrument is such that sufficiently high dilutions and narrow enough slit widths can be utilized to adequately mitigate interference by uranium. In the determination of calcium, however, a series of standard curves prepared with solutions containing uranium in concentrations approximating those found in the samples are required. It was discovered that the intensity of the 422-m μ peak of calcium in the presence of U , PO_4^{3-} , and SO_4^{2-} is the same as it is when uranium alone is present. This is true only when the uranium concentration is in excess of the PO_4^{3-} and SO_4^{2-} . The samples are digested in HNO_3 and diluted with an aqueous-organic solvent for the flame determination. Good precision is attained. (auth)

12466 TID-7568(Pt. 1)(p.205-12)

National Lead Co. of Ohio, Cincinnati.

DIRECT FLAME PHOTOMETRIC METHOD FOR THE DETERMINATION OF MICROQUANTITIES OF ALKALI METALS IN CONCENTRATED SOLUTIONS OF URANYL NITRATE. W. G. Ellis and E. A. Brown. p.205-12 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 8p.

A direct method was developed for the flame photometric determination of microgram quantities of so-

dium, lithium, and potassium in concentrated $\text{UO}_2(\text{NO}_3)_2$ solutions. A study was made of the flame emission spectra of the uranium matrix material in the vicinity of the alkali-metal line. Variations in the background emission are minimized by correcting the alkali-metal transmission value for the background transmission measured on each side of the maxima. A calibration curve is constructed from the net transmission values of standards similarly measured. A method for the direct determination of the alkali elements in the presence of varying amounts of uranium and nitric acid is presented. By this method, sodium, lithium, and potassium in the concentration range 1 to 5 $\mu\text{g}/\text{ml}$ can be determined in the presence of as much as 100 mg/ml of uranium. The time required for an analysis is approximately 30 minutes. The standard deviation for sodium in the range of 10 ppm was found to be 0.2 ppm. (auth)

12467 TID-7568(Pt. 1)(p.213-23)

Mallinckrodt Chemical Works, St. Charles, Mo.
THE DETERMINATION OF SMALL AMOUNTS OF MAGNESIUM IN URANIUM WITH THE FLAME PHOTOMETER. C. H. McBride and W. A. Ziegler. p.213-23 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 11p.

The concentration of magnesium in uranium or uranium compounds may be determined by a flame photometric method without prior separation of the magnesium and uranium. The material is dissolved in a $\text{HCl}-\text{H}_2\text{O}_2$ solution, following which the solution is diluted with acetone. This solution is aspirated into a hydrogen-oxygen flame and the emission of the Mg 2852-A line is measured. The interference of uranium is overcome by the use of calibration standards which contain uranium in the same concentration as the samples. Lithium, sodium, HNO_3 , H_2SO_4 , and H_3PO_4 interfere with the determination, but no other interferences have been noted. For samples containing from 10 to 50 ppm of magnesium, the precision, expressed as the limit of error for a single determination at the 95-per cent confidence level, was found to be about 4 ppm; at lower concentrations, the precision was 45 per cent. (auth)

12468 TID-7568(Pt. 1)(p.224-32)

Mallinckrodt Chemical Works, St. Charles, Mo.
THE INDIRECT ASSAY OF URANIUM TETRAFLUORIDE BY THE POLAROGRAPHIC DETERMINATION OF URANYL FLUORIDE. T. J. Kneip and J. D. Dowdy. p.224-32 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 9p.

Uranyl fluoride occurs in UF_4 produced by the high-temperature reduction and hydrofluorination of UO_3 . In the past, the UO_2F_2 content has been determined by various leaching procedures, or calculated from the difference between the total U and U(IV). The leaching procedures are subject to errors due to the hydrolysis of the UF_4 and occlusion of UO_2F_2 . In the calculation method large relative errors are introduced as a consequence of small relative errors in the magnitude of the large values actually determined. To circumvent these difficulties, the U(VI) in the UO_2F_2 is determined polarographically after dissolving the sample in an

$(\text{NH}_4)_2\text{C}_2\text{O}_4$ solution, which does not dissolve a significant amount of the U_3O_8 in the sample. The result of this determination is used to calculate a more accurate assay value than that obtainable by the method involving the determination of U(IV) and subsequent calculation of U(VI). (auth)

12469 TID-7568(Pt. 1)(p.233-40)

Knolls Atomic Power Lab., Schenectady, N. Y.
THE DETERMINATION OF SILVER, CADMIUM, INDIUM, AND TIN IN SILVER-BASE ALLOYS. D. P. Strickos and J. T. Porter, II. p.233-40 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 8p.

Also issued separately as KAPL-1911.

This paper was previously abstracted and appears in NSA, Vol. 13, as abstract No. 58.

12470 TID-7568(Pt. 1)(p.243-52)

National Lead Co. of Ohio, Cincinnati.
THE DETERMINATION OF INDIVIDUAL RARE EARTHS IN PRODUCT URANIUM. M. G. Atwell, C. E. Pepper, and G. L. Stukenbroeker. p.243-52 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 10p.

The procedure described includes the chemical separation of the rare-earth elements from product uranium and from uranium ores and concentrates. The separated rare-earth oxides are analyzed spectrographically for the individual rare-earth elements. (auth)

12471 TID-7568(Pt. 1)(p.253-7)

National Lead Co. of Ohio, Cincinnati.
SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN URANIUM-MOLYBDENUM ALLOYS. E. R. Barker, C. E. Pepper, and G. L. Stukenbroeker. p.253-7 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 5p.

A method for the spectrographic analysis of 20 or more impurity elements in a 7.5 per cent U-Mo alloy is described. The elements, the spectral lines used, and the concentration ranges covered are included. (auth)

12472 TID-7568(Pt. 1)(p.258-64)

Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.
A FLUORESCENT X-RAY SPECTROGRAPHIC METHOD OF ANALYZING TITANIUM-COLUMBIUM ALLOYS. D. E. Fornwalt and J. Komisarek. p.258-64 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 7p.

An x-ray fluorescent method is described for the determination of the two principal components of titanium-columbium alloys. For the determination of titanium at the 1- to 50-per cent level and columbium at the 50- to 99-per cent level, the alloy is first converted to the

oxides. Following oxidation, the sample is fused with $\text{Na}_2\text{B}_4\text{O}_7$ and the bead thus formed is analyzed by measuring the fluorescent x-rays it produces when exposed to x-radiation from a tungsten target. At the 50-per cent titanium level, a precision of three per cent is obtained. It is believed that the method may be extended to the analysis of other alloy systems of the type described. (auth)

12473 TID-7568(Pt. 1)(p.265-78)

Washington, Univ., Seattle and Aerojet-General Nucleonics, San Ramon, Calif.

URANIUM IMPURITY IN AN MTR BERYLLIUM SHIM SAFETY ROD. J. I. Mueller and H. G. Simens. p.265-78 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 14p.

This work was originally reported in Pratt and Whitney report PWAC-157.

A beryllium shim safety rod, which was cut up in the Pratt and Whitney Aircraft hot cells, was found to be alpha-contaminated. This rod had been used in the MTR for $2\frac{1}{4}$ years. Alpha pulse-height analysis indicated the presence of heavy-element impurities. Samples having a specific activity of 1.5 rem/hr (β, γ) per gram at 1 ft were analyzed by x-ray fluorescent spectrometry. The analytical results indicated a uranium concentration of 485 ppm. After correcting for 8.25 per cent burnup, the original concentration in the beryllium was calculated to be 540 ppm. Analog computer calculations based upon the presence of 17.5 mg of Cm^{244} in the beryllium rod indicated that the initial concentration of uranium was 1900 ppm. The discrepancy between the uranium values can probably be attributed to the exclusion of resonance-capture effects in the computer calculations. (auth)

12474 TID-7568(Pt. 1)(p.279-86)

Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.

A METHOD FOR THE SPECTROGRAPHIC DETERMINATION OF TRACE IMPURITIES IN COLUMBIUM. D. E. Fornwalt and M. K. Healy. p.279-86 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 8p.

A method is presented for the spectrographic determination of 13 elements which may be present in niobium metal. These elements and their concentration ranges are: boron, 0.0001 to 0.0015 per cent; aluminum, cadmium, chromium, cobalt, iron, manganese, nickel, silicon, tin, titanium, and zirconium, 0.001 to 0.1 per cent; tantalum, 0.025 to 1.5 per cent; and zirconium, 0.1 to 1.5 per cent. (auth)

12475 TID-7568(Pt. 1)(p.287-93)

National Lead Co. of Ohio, Cincinnati.

A STUDY OF THE SPECTROGRAPHIC EXCITATION OF IRON WITH IRON-59. M. G. Atwell, C. E. Pepper, and G. L. Stukenbroeker. p.287-93 [of] ANALYTICAL CHEMISTRY IN NUCLEAR REACTOR TECHNOLOGY. PART 1. SPECIFIC APPLICATIONS OF DIVERSE METHODS OF CHEMICAL ANALYSIS. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958. 7p.

The behavior of iron during the spectrographic car-

rier distillation excitation of U_3O_8 was studied. Uranium oxide samples were excited by a routine analytical method in which 2 per cent Ga_2O_3 is used as a carrier and also by an experimental method in which a mix of 2 per cent Ga_2O_3 -4 per cent BeO is used as a carrier material. After the excitation of the U_3O_8 charges in both procedures, iron-59 was used to trace the disposition of iron. The amounts of iron volatilized, diffused into the electrodes, and remaining in the residual U_3O_8 charges are presented. Percentage figures are given which show the disposition of iron after five successive returns of residual U_3O_8 charges. The percentage of iron volatilized during excitation is independent of the iron concentration in the U_3O_8 charge for the range, 5-500 ppm, which was investigated. Approximately five times as much iron was volatilized into the arc stream in the experimental method as was volatilized in the routine procedure. (auth)

12476 UCRL-8558

California, Univ., Berkeley. Lawrence Radiation Lab. BUBBLING FROM PERFORATED PLATES (thesis). Robert S. Brown. Dec. 1958. 142p. Contract W-7405-eng-48. \$2.75(OTS).

A 6-inch-square column was used to investigate certain operating characteristics of perforated plates. The amplitude and frequency of the pressure fluctuations in the chamber under the plates were studied. The time-average pressure drop across a plate and dumping rate of liquid through the holes were also investigated. Various gas-liquid systems were used to study the effects of the physical properties of the system. The effect of a plate having single 0.25-in.-diam. hole and multihole plates with holes of 0.25-, 0.375-, and 0.50-inch diam. on 2-, 3-, and 4-diam. triangular spacings were studied. The frequencies varied from 10,000 to 100,000 hr^{-1} and the amplitude ranged from 0.8 to 18 lbs_f/ft^2 . The total pressure drop minus the clear-liquid head varied from 0.8 to 13 lbs_f/ft^2 . Time-average dumping rates with all the holes assumed to be operating ranged from 0.001 to 0.1 ft/sec, and time-average gas velocities covered the range from 5.0 to 100 ft/sec. Correlations of the frequency and pressure drop were obtained. No theoretical or empirical approach gave an adequate correlation for the amplitude. The dumping data from single-hole plates were correlated in terms of the frequency, amplitude, and pressure drop by the application of the theory of flow through a sharp-edged orifice. The multihole dumping was found to result from a complicated interaction of the bubbling from neighboring holes. However, no theoretical or empirical approach adequately correlated the data. Some dumping data were obtained on a 2- by 2-ft tower, and a possible method of correlation proposed. (auth)

12477 UCRL-8683

California, Univ., Berkeley. Lawrence Radiation Lab. RECENT RESEARCH ON TRANSPLUTONIUM ELEMENTS. Stanley G. Thompson. [Mar. 1959]. 18p. Contract W-7405-eng-48. \$3.30(ph), \$2.40(mf) OTS.

Presented at Mendelev Chemistry Conference, Moscow, March 1959.

Work which is being done on very heavy elements at the Lawrence Radiation Laboratory is described. The subject matter is presented in three broad classifications including production of isotopes, their chemical properties, and studies of nuclear properties. The elements which are discussed include Bk, Am, Cm, and Cf. (J.R.D.)

12478 UCRL-8714

California. Univ., Berkeley. Lawrence Radiation Lab. TECHNIQUES USED FOR THE PRODUCTION AND IDENTIFICATION OF THE TRANSPUTONIUM ELEMENTS. Albert Ghiorso. [Mar. 1959]. 21p. Contract W-7405-eng-48. \$4.80 (pb), \$2.70 (mf) OTS.

Presented at Mendeleev Chemistry Conference, Moscow, March 1959.

A study was made of the production and identification of the transplutonium elements with atomic number greater than 94. A detailed discussion is presented of the identification of elements 101 and 102 and the possible applications of these methods to elements beyond. A brief review of the discovery of all of the transplutonium elements is given to show the gradual change in experimental techniques. (J.E.D.)

12479 USNRDL-TR-312

Naval Radiological Defense Lab., San Francisco. QUANTITATIVE RADIOCHEMICAL ANALYSIS BY ION EXCHANGE. IV. URANIUM AND TELLURIUM. L. Wish. Mar. 27, 1959. 17p.

Te radionuclides from fission product mixtures are eluted together with U from Dowex-2 anion resin in quantitative radiochemical procedures. The separation of these two elements from each other is necessary for their determination. The adsorption of Te(IV) from H_3PO_4 solutions was investigated. From similar data on U(VI) a procedure for the separation of Te was obtained. Column runs indicated that the yields were quantitative and the purities greater than 99%. The procedure was then expanded so as to permit inclusion in the sequential radiochemical analytical scheme for mixed fission product and actinide elements. (auth)

12480 WADC-TR-58-51 (Pt. II)

Illinois. Univ., Urbana. HIGH POLYMERIC MATERIALS. [Period covered]: January 1, 1958 and January 31, 1959. Carl S. Marvel, Ludwig F. Audrieth, and John C. Bailar, Jr. Jan. 1959. 171p. Project title: RUBBER, PLASTICS AND COMPOSITE MATERIALS. Task title: RESEARCH ON THERMALLY STABLE POLYMERS FOR HIGH TEMPERATURE AIRCRAFT APPLICATION. Contract AF33 (616)-5486.

An intractable p-polyphenyl mixed with carbon black has been obtained, but due to complete insolubility, its molecular weight has not been established. Poly- α, α' -dimethylenepimelonitrile which contains a cyclohexane recurring unit has been characterized and shown to have a better heat stability than does polyacrylonitrile. An interesting polymeric cyclic silicon compound has been prepared from diallyldimethylsilane. Polymers containing pyridine rings along with vinyl ketone monomer units have been prepared but show disappointing heat stabilities. It has not been possible to get polyphthalocyanines of high molecular weight. The products appear to be di- or trimeric rather than polymeric. Reaction of benzene phosphonic diamide with aqueous formaldehyde gives small yields of a dimethylol derivative. Side reactions necessitated a study of the hydrolysis of the diamide, both in water under varying pH conditions and in 100% acetic acid. Condensation reactions of benzene phosphonic amide with polyamines lead to elimination of ammonia and formation of low melting, glassy products which are presumably cyclic derivatives. The hydrochlorides, phosphates and benzene phosphonates of hexamethylene diamine, diethylene triamine and ethylene diamine have been prepared and characterized. The di-

and hexa-substituted N-n-dibutyl phosphonitrimides are less stable thermally than the hexa-N-phenyl derivative of triphosphonitrile. Sodium-liquid ammonia is used to decompose chlorine-containing phosphonitrilic derivatives as the first step in the quantitative determination of chlorine in such compounds. The trimeric and tetrameric phosphonitrilic isothiocyanates have been prepared by metathesis in acetone solution. These substances polymerize to rubber-like products when heated above 150°, and undergo reactions characteristic of the -NCS group with ammonia, amines, alcohols, mercaptans and hydrazines. Several bis-aminophenols and bis-8-hydroxyquinolines have been prepared, and have been made to react with the divalent, tetracoordinate ions of copper and zinc. The substances so formed are undoubtedly polymeric, but are of low molecular weight. Attempts to form substances of higher molecular weight are planned. Attempts have been made to prepare bis-catechol derivatives and 2,2',6,6'-tetrahydroxybiphenyl, but these have not yet been obtained in good yield. The work is continuing; when the materials are obtained, they will be made to react with silicon tetrachloride. A short chain polymer has been prepared from methylenedisilicylic acid and silicon tetrachloride. Studies of new methods of polymerization are being undertaken in the hope of learning more about the polymerization process. (auth)

12481 AEC-tr-3647

DETERMINATION OF FLUORINE PRESENT IN VERY SMALL QUANTITIES BY A CONDUCTOMETRIC METHOD. J. Harms and G. Jander. Translated for Savannah River Lab. from Z. Elektrochem. 42, 315-19 (1936). 13p. \$3.30 (pb), \$2.40 (mf) JCL or LC.

A conductometric determination of macro and micro quantities of fluorine is described. The titration is done in a weak acetic acid solution. Chloride, nitrate, sulfate, and silicate do not interfere. (J.R.D.)

12482 CEA-tr-A-529

ECHANGEURS D'ANIONS LIQUIDES. (Liquid Ion Exchangers.) U. Schindewolf. Translated into French from Z. Elektrochem. 62, 335-40 (1958). 20p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1175.

12483 CEA-tr-R-599

CONDUCTIBILITÉ ÉLECTRIQUE DES SULFURES D'ÉTAIN, D'ANTIMOINE, DE BISMUTH ET DE NICKEL À L'ÉTAT FONDU. (Electric Conductivity of the Sulfides of Tin, Antimony, Bismuth, and Nickel in the Fused State.) Yu. K. Delimarskii (Delimarsky) and A. A. Velikanov. Translated into French from Zhur. Neorg. Khim. 3, 1075-8 (1958). 12p.

The electric conductivity of Bi_2S_3 and NiS in the fused state exceeds that of fused salts and approaches the conductivity of some metals. The conductivity of Sb_2S_3 has a value of the same order as that of fused salts. Positive temperature coefficients were found for Sb_2S_3 and SnS , but the electric conductivity of Bi_2S_3 and NiS is characterized by negative temperature coefficients. The variation of the specific electric conductivity of the fused sulfides is described by the Frenkel equation. It is hypothesized that the tin and antimony sulfides have a conductivity of electrolytic character, whereas that of bismuth and nickel sulfides is an electron conductivity. The character of the electric conductivity varies in the same order as the chemical properties of the corresponding oxides. (tr-auth)

12484 CEA-tr-R-634

SYNTHESE DES FLUORURES SUPERIEURS DE NIOBIUM, DE TANTALE ET DE MOLYBDENE EN UTILISANT LE TRIFLUORURE DU CHLORE. (Synthesis of Higher Fluorides of Niobium, Tantalum, and Molybdenum Using Chlorine Trifluoride.) N. S. Nikolaev, Yu. (Iu.) A. Buslaev (Bouslaev), and A. A. Opalovskii (Opalovsky). Translated into French from Zhur. Neorg. Khim. 3, 1731-3(1958). 9p.

The pentafluorides of niobium and tantalum and molybdenum hexafluoride were prepared by the fluorination of metallic powders with chlorine trifluoride. Quartz apparatus was used. The fluorides were purified by fusion, distillation over metallic powders, and washing the products with liquid hydrogen fluoride. (tr-auth)

12485 CEA-tr-R-640

DOSAGE DE L'HYDROGENE DANS LE TANTALE, LE NIOBIUM ET L'URANIUM. (Determination of Hydrogen in Tantalum, Niobium, and Uranium.) A. N. Zaidel and K. I. Petrov. Translated into French from Zavodskaya Lab. 24, 1000-1(1958). 5p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 10928.

12486 CEA-tr-X-122

REMARQUES SUR LA METHODE DE DECOMPOSITION DES ECHANTILLONS DE PLOMBAGINE AINSI QUE SUR LA METHODE DE DISTILLATION DU BORE. (Remarks on The Decomposition Method for Samples of Graphite as well as the Distillation Method for Boron.) Hiro K. Murkii. Translated into French from Nippon Kagaku Zasshi 78, 850-4(1957). 13p.

The determination of boron in samples of graphite was investigated. The characteristics of calcium hydroxide and calcium saccharate for the recovery of boron in the thermal decomposition of the sample were studied, and the accuracy in the determination of boron by this method was established. Several types of distillation apparatus for the distillation of boron were compared, and the conditions for boron distillation were determined. (J.S.R.)

12487 CEA-tr-X-124

DOSAGE DU PRASEODYME, DU NEODYME ET DU SAMARIUM EN FAIBLE QUANTITE CONTENUS DANS L'OXALATE DE LANTHANE. (Determination of Praseodymium, Neodymium, and Samarium in Low Quantities in Lanthanum Oxalate.) Giichi Muto and Masato Miyama. Translated into French from Bunseki Kagaku 7, 21-4(1958). 11p.

A spectrophotometric method for the determination of low quantities of Pr, Nd, and Sm in lanthanum is presented. Most of the lanthanum is removed by fractional precipitation with oxine. The pH conditions best suited for the precipitation and the effects of reprecipitation were determined. After removal of the lanthanum the concentration of Pr, Nd, and Sm can be determined spectrophotometrically. (J.S.R.)

12488

DETERMINATION OF MICROGRAM AMOUNTS OF COBALT IN SODIUM METAL. 2-NITROSO-1-NAPHTHOL SPECTROPHOTOMETRIC METHOD.

Louis Silverman and Rachel L. Seitz (Atomic International Div., North American Aviation, Inc., Canoga Park, Calif.). Anal. Chim. Acta. 20, 340-3(1959) Apr.

A colorimetric method, with 2-nitroso-1-naphthol, is outlined for determining Co in Na metal, which is used as a coolant in nuclear reactors. The Na metal is

reacted with water, neutralized with HCl and the Co content determined; the cobalt nitrosonaphtholate is extracted with CCl_4 and the absorbance is measured at 535 m μ . Chloride ion is requisite for the extraction of the Co complex in dilute solutions. Li and K as well as Na have no effect. Ammonium ions have an adverse effect. As little as 0.1 ppm Co can be determined in Na metal. In order to determine Co in the fractional ppm range, 10 g of sample are used. The molar extinction coefficient is 11,780. (auth)

12489

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM. APPLICATION OF THE METHOD TO THE ANALYSIS OF LEACH SOLUTIONS AND MONAZITE. K. S. Koppikar, V. G. Korgaonkar, and T. K. S. Murthy (Atomic Energy Establishment, Trombay, India). Anal. Chim. Acta 20, 366-71(1959) Apr.

Uranyl thiocyanate complex is extracted from a slightly acid solution, using tributyl phosphate-carbon tetrachloride as solvent. The effect of various factors on the extraction of uranium and the interference of a number of cations and anions was studied. After extraction, uranium is determined spectrophotometrically in the organic solvent. (auth)

12490

THE APPARENT SOLUBILITY PRODUCT OF CEROUS FLUORIDE. Joyce L. Weaver and William C. Purdy (Univ. of Connecticut, Storrs). Anal. Chim. Acta 20, 376-9(1959) Apr.

The apparent solubility product of cerous fluoride was determined to be $(8.1 \pm 1.1) \times 10^{-16}$ and $(1.1 \pm 0.5) \times 10^{-15}$ by radiometric and conductometric methods, respectively. Hydrolysis of cerous fluoride is thought to be negligible. The effect of hydrogen-ion concentration on the solubility of cerous fluoride was measured in solutions of perchloric acid of varying acidity. The solubility was found to decrease slightly as the pH decreased from 5 to 2 and then to increase rapidly as the pH further decreased from 2 to 0. (auth)

12491

STUDIES ABOUT THE ANALYTICAL SIGNIFICANCE OF SOME REDUCTONES. VANADIUM-TRIOSE-REDUCTONE COMPLEX AND URANYL-REDUCTIC ACID COMPLEX. J. M. Hojman, V. G. Dražić, A. A. Muk, and M. B. Pravica. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 9, 43-55(1959).

Formation of a +5 vanadium complex with TR was investigated and its composition determined by Job's method. It was observed that the high molecular absorbency index of the complex makes possible the spectrophotometric determination of V in trace amounts even in the presence of some other cations. Two well developed waves which are of analytical significance were formed by the reduction of the complex at the dropping Hg-electrode. The formation of uranyl complex with reductic acid was further investigated and its analytical use discussed. (auth)

12492

SEPARATION OF FISSION PRODUCTS AND CORROSION ELEMENTS ON ALUMINUM OXIDE. Dorde S. Nemoda. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) 9, 95-103(1959).

Use of Al_2O_3 for the chromatographic separation of long-lived radioactive isotopes and corrosion elements from a mixture of fission products was examined. By proper choice of eluents, the mixture was separated

into fractions containing one or more elements. Experiments were carried out with artificial mixtures containing the following elements: Cs¹³⁷, Sr⁹⁰-Y⁹⁰, Ba¹⁴⁰-La¹⁴⁰, Ce¹⁴⁴-Pr¹⁴⁴, Zr⁹⁵-Nb⁹⁵, Ru¹⁰³-Rh¹⁰³, Te, Fe, Co, Ni, Mo, Cr, Al, Pb, and U. (auth)

12493

ON SPECTROCHEMICAL DETERMINATION OF THORIUM BY D. C. ARC. Momir D. Marinković. *Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade)* 9, 215-17(1959).

A modification of the method of Dutra and Murata for the direct determination of thorium in minerals is proposed. Errors reducing the accuracy of the spectrochemical analysis are discussed. By using cupric oxide as a buffer, the background was weakened in the spectra leading to more accurate results at smaller concentrations. Precision for samples at different concentrations was about 4% in terms of standard deviation. The maximum error was about 8%, in good agreement with the data of Dutra and Murata. (A.C.)

12494

DETERMINATION OF CERIUM BY POTASSIUM PERIODATE. I. V. Puzdrenkova, I. P. Alimarin, and V. A. Frolkina. *Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim.* 13, No. 2, 183-6(1958). (In Russian)

The composition of tetravalent cerium periodate in acid medium was determined. A method is suggested for the gravimetric and indirect colorimetric determination of cerium and for the quantitative determination of cerium in monazites. (R.V.J.)

12495

ABSORPTION SPECTRA OF COMPLEXES WITH QUERCETIN. 1. THORIUM DETERMINATION IN MONAZITE SANDS. I. P. Alimarin, A. P. Golovina, A. F. Kuteinikov, and N. F. Stepanov. *Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim.* 13, No. 2, 203-6(1958). (In Russian)

The absorption spectra of quercetin with Al, Be, Ce(III), Cu(II), Fe(III), Ga, La, Sn(IV), Th, Ti, U(VI), and Zr were studied. A photometric method is suggested for determining Th in quercetin and monazite sands. (R.V.J.)

12496

SEPARATION OF SMALL QUANTITIES OF TANTALUM FROM TITANIUM BY PYROGALLIC ACID. A. P. Savostin and I. P. Alimarin. *Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim.* 13, No. 2, 211-15(1958). (In Russian)

Separation of Ta from Ti by pyrogalllic acid precipitation in the presence of fluorine ions is described. Radiometric tests showed 70 to 80% extraction after three precipitations. The ratio of Ta: Ti in the final precipitant was 1: 0.2 to 0.4 or a factor of 5000 enrichment. (R.V.J.)

12497

KINETICS OF THE HYDROLYSIS OF BORON AMINE TRIFLUORIDE. I. G. Ryss and S. L. Idel's (Dnepropetrovsk Inst. of Transportation). *Zhur. Fiz. Khim.* 33, 374-80(1959) Feb. (In Russian)

A method was developed for the direct determination of boron amine trifluoride in the presence of products of its hydrolysis. The hydrolysis of H₃N: BF₃ in aqueous solutions is a first order reaction. The dependence of the rate constant (in min⁻¹) on the temperature is described by the equation $\lg k_{\text{min}^{-1}} = 14.70 - 5945/T$. The experimental energy of activation equals 27.2 kcal

min⁻¹, the entropy of activation $\Delta S^\ddagger = 3.2$ cal. degree⁻¹. The hydrolysis of H₃N: BF₃ is not catalyzed by H⁺ ions. It is catalyzed by F⁻ ions proportionally to their concentration and proceeds very rapidly under the action of OH⁻. The experimental activation energy is not changed in the presence of F⁻ ions. (auth)

12498

THE CATALYTIC ACTIVITY OF THE RARE ELEMENTS IN THE DECOMPOSITION OF HYDROGEN PEROXIDE. F. M. Perel'man, A. Ya. Zvorykin, and S. K. Shakhova (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, U.S.S.R.). *Zhur. Fiz. Khim.* 33, 452-6(1959) Feb. (In Russian)

A study was made of the catalytic activity of systems composed of the salts of rare elements (sodium gallate, thorium nitrate, titanium sulfate, and germanium chloride) in association with the salts of copper, cobalt, iron, and manganese. The reaction studied, the decomposition of hydrogen peroxide, was carried out in a homogeneous medium at a temperature of 25°C and pH = 8.0. In a number of cases the curves representing the changes in the rate constants of the reaction with respect to the catalyst composition were found to possess maxima greatly in excess of their additive values. Thus highly active catalysts were formed at definite component ratios in the following systems: sodium gallate—copper chloride; thorium nitrate—potassium permanganate; thorium nitrate—copper chloride; titanium sulfate—copper chloride; titanium sulfate—cobalt chloride; and germanium chloride—copper chloride. (auth)

12499

QUANTITATIVE MASS SPECTROGRAPHIC DETERMINATION OF EXTREMELY SMALL ALKALI MASSES BY THE METHOD OF COMPLETE EVAPORATION. H. Voshage and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). *Z. Naturforsch.* 14a, 216-29(1959) Mar. (In German)

In an improved surface ion source with extremely low substance consumption, Cs in quantities of 2×10^{-6} to 5×10^{-13} g were completely evaporated and the Cs ion beams was measured on the collector of a mass spectrometer as a function of time. The Cs ion yield of the source with an evaporation velocity of 10^{-13} to 10^{-10} g/min was shown to be constant so that the total ion yield of the mass spectrometer for Cs was reproducible and was larger than 7 to 8%. When the apparatus was calibrated by evaporation of known cesium quantities, unknown cesium masses between 10^{-12} and 2×10^{-6} could be determined by complete evaporation in the ion source with a mean error of less than 10%. Since small standards could be prepared only with an error of 10%, the error of the absolute determination was 20%. The physical and apparatus assumptions for the application of the method to the determination of other alkali metals were discussed. (The determination of K⁴⁰ traces which were separated from iron meteorites and originated almost completely from nuclear transformations caused by the effects of cosmic radiation on the meteorite material will appear in this journal.) Preliminary examinations on simultaneous determination of all alkali metals in minerals, in which approximately 10^{-6} g of the mineral was strongly heated in the ion source and the evaporated alkali metals ionized and measured, show that in this case with ion source temperatures of over 2000°K a satisfactory analysis result is to be expected. (tr-auth)

12500

THE NICKEL COATING PROCESS WITH AMMONIUM FLUORIDE. N. A. Solov'ev. *Zhur Priklad. Khim.* 32, 566-72(1959) Mar. (In Russian)

The effects of coating solution composition and operational conditions on the rate of nickel coating deposition and coating hardness and porosity are investigated. (R.V.J.)

12501

TEKHNICA FIZIKO-KHIMICHESKIKH ISSLEDOVANI PRI VYSOKIKH DAVLENIYAKH. IZDANIE VTOROE, PERERABOTANNOE I DOPOLNENNOE. (Techniques of Physico-Chemical Investigation at High Pressures. Second Edition, Corrected and Supplemented.) D. S. Tsiklis. Moscow, State Scientific-Technical Publishing House of Chemical Literature, 1958. 304p.

Data on the selection of materials, construction of apparatuses, and experimental procedures are discussed. Methods for obtaining and measuring high and super-high pressures at high temperatures are analyzed, as well as mixing procedures under pressures. The phase equilibrium, gas compression, measurements of surface tension at liquid-gas boundaries, and wetting of solid bodies in compressed gases are described. The book was planned for engineers and personnel interested in physico-chemical investigations at high pressures. (R.V.J.)

12502

IMPROVEMENTS IN OR RELATING TO REFINING METAL BY ELECTRODEPOSITION. Allan Robert Gibson (to United Kingdom Atomic Energy Authority). British Patent 810,091. Mar. 11, 1959.

A process for purifying metals by electrodeposition from a molten salt bath is described. The metal to be purified is placed on the graphite anode plate in the molten salt. The cathode is made of the pure metal which is being refined. An alumina cup or other inert-material cup is provided at the anode to catch electrodeposited metal which does not adhere. An inert gas atmosphere is provided. (T.R.H.)

12503

RECOVERY OF PROTACTINIUM. (to United Kingdom Atomic Energy Authority). British Patent 810,542. Mar. 18, 1959.

Recovery of Pa from irradiated Th is described. The Th is dissolved in HNO_3 and, if necessary, the Pa is carried down in repeated MnO_2 precipitations. The Pa solution thus obtained or the crude HNO_3 solution is passed over phenol-formaldehyde resin on which the Pa is adsorbed. The Pa is eluted from the resin with NH_4F or HF aqueous solution. (T.R.H.)

12504

PROCESS FOR PURIFYING TITANIUM TETRAHALIDES OR ZIRCONIUM TETRAHALIDES. Raymond James Wigginton and Howard Arthur Stanley Bristow (to Laporte Titanium, Ltd.). British Patent 810,822. Mar. 25, 1959.

A fluidized bed process for purifying ZrCl_4 or TiCl_4 is presented. The halide vapor from the halogenation step is passed directly through a fluidized bed of metal or metal-coated particles where impurities such as V react with the metal. The fluidized bed may consist of Cu, Zn, Fe, Ni, Ca, Mg, Al, Ti, Pb, Sb, Sn, or Na particles. A three-zone process is described in which two zones are being fluidized and used while the third zone is being recharged with metal powder. (T.R.H.)

12505

IMPROVEMENTS IN OR RELATING TO VESSELS FOR PROCESSING NUCLEAR FUEL. Ronald Tunstall Ackroyd, Dennis Kenyon, and Derek Edmund Abel (to United Kingdom Atomic Energy Authority). British Patent 811,790. Apr. 15, 1959.

A dissolver for highly enriched fuel is described. The vessel consists of a central column with a steam jacket surrounded by a neutron absorbing material. A tank encloses this arrangement so that the central column is connected with the surrounding tank. Thus fuel elements in the central column are covered with HNO_3 and heated. The liquid flows by convection up the column and down around the outside of the neutron absorbing material. (T.R.H.)

12506

IMPROVEMENTS IN OR RELATING TO THE RECOVERY OF RUTHENIUM. William Edmund Grummitt and William Horton Hardwick. British Patent 812,682. Apr. 29, 1959.

Solvent extraction recovery of Ru from HNO_3 solutions from which U has already been extracted is described. The pH is adjusted to 1 to 3 by NH_4OH , then a wash with $\text{C}_2\text{H}_2\text{Cl}_4$ removes organic solvent. The Ru is then oxidized to the octavalent state by $\text{Ce}(\text{NO}_3)_4 \cdot 2\text{NH}_4\text{NO}_3$. The Ru is then extracted into $\text{C}_2\text{H}_2\text{Cl}_4$, washed with $\text{Ce}(\text{NO}_3)_4 \cdot 2\text{NH}_4\text{NO}_3$ solution, and recovered in HCl solution. (T.R.H.)

12507

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF RADIOACTIVE PHOSPHORUS. (to Institut für Atomenergi). British Patent 812,701. Apr. 29, 1959.

Radioactive P is separated from irradiated S by aqueous extraction. The S should be finely powdered ($\sim 5\mu$) to allow adequate contact with the water. The extraction is accomplished by refluxing the irradiated, powdered S in water at 95 to 100°C . A wetting agent should be used, preferably sec-octyl alcohol which is easily removed subsequently. The P is in the solution as H_3PO_4 . (T.R.H.)

12508

IMPROVEMENTS IN THE PROTECTION OF GRAPHITE AGAINST GAS CORROSION AT ELEVATED TEMPERATURES. Harold Rawson and Peter Lewis Baynton (to The British Thomson-Houston Co., Ltd.). British Patent 812,740. Apr. 29, 1959.

An aluminum phosphate-based coating for graphite is offered. To an aluminum phosphate solution with an Al_2O_3 to P_2O_5 ratio of 1:3 is added sufficient graphite powder, ZrO_2 powder, and Bi_2O_3 in the ratio of 6:1:1 to make a paste. The paste is sprayed or painted on graphite, dried 1 hour at 130°C , and fired to 400°C . (T.R.H.)

12509

ACTIVATED URANIUM DIOXIDE AND PROCESSES OF PRODUCING THE SAME. (to United Kingdom Atomic Energy Authority). British Patent 812,791. Apr. 29, 1959.

Reduction of UO_3 to UO_2 by CH_4 gas at 400 to 500°C results in UO_2 sufficiently active to oxidize in ordinary air at room temperature. This active UO_2 is readily chlorinated. (T.R.H.)

12510

PROCESS FOR PRODUCING URANIUM TETRACHLORIDE. (to United Kingdom Atomic Energy Authority.) British Patent 812,792. Apr. 29, 1959.

An apparatus for producing UCl_4 by reacting CCl_4 with UO_2 is described. Powdered UO_2 is introduced at the high end of an inclined, rotating reaction tube, and CCl_4 vapor enters at the low end. A heating muff maintains reaction vessel temperature at 450 to 475°C. The UCl_4 emerges at the lower end. (T.R.H.)

12511

IMPROVEMENTS IN OR RELATING TO ELECTRO-MAGNETIC INTERACTION PUMPS. William George Hutchinson and Leslie Charles Cole (to United Kingdom Atomic Energy Authority). British Patent 813,005. May 6, 1959.

Since the pump channel of an electromagnetic pump must be thin to reduce reluctance, some means of strengthening it must be used. A pump design is described which incorporates an adjustable spring arrangement for tensile loading of the pump channel to counteract compressive stresses due to thermal or gravitational effects. (T.R.H.)

Radiation and Radiochemistry

12512 AECU-4100

Nuclear-Chicago Corp., Chicago.

EXPLORATION OF RADIOMETRIC METHODS. Report No. 1. Benjamin F. Scott and William J. Driscoll. Apr. 2, 1959. 7p. Contract AT(11-1)-695. \$1.80(ph), \$1.80(mf) OTS.

General schemes of radiometric analytical procedures are outlined which divide elements of the periodic table into groups which are precipitable by a common reagent. (W.L.H.)

12513 AERE-C/M-380

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF RADIOSTRONTIUM IN SEA WATER. B. A. Loveridge. Mar. 1959. 9p. \$0.25 (BIS).

Radiostromium is determined in sea water by precipitation from an aliquot in the presence of strontium carrier. Interfering radionuclides are removed by a series of precipitations and scavenges before the radiochemically pure strontium is precipitated as the oxalate. The absolute activity is determined by comparison with a standard source prepared from a 4π counted solution of $\text{Sr}^{90}-\text{Y}^{90}$. (auth)

12514 BNL-545

Brookhaven National Lab., Upton, N. Y.

CATALYTIC DECOMPOSITION OF NITROUS OXIDE. Meyer Steinberg. Mar. 1959. 10p. \$0.50(OTS).

In processing waste gas streams from nuclear fuel plants for recovery of the noble gases, nitrous oxide must first be removed. A catalyst consisting of 0.5% rhodium supported on $\frac{1}{8}$ -in. alumina pellets has been found capable of decomposing nitrous oxide in simulated waste gas streams at catalyst temperatures ranging from 343 to 413°C, when gas space velocities range from 525 to 2220 standard cubic feet of gas per hour per cubic foot of packed catalyst volume. Hydrogen in concentrations up to 2.3% is simultaneously removed from the entering gas streams. Gases containing 5.6 to 22.0% by volume N_2O , 1.6 to 2.3% H_2 , and 13.3 to 17.8% O_2 , the remainder being N_2 , were reduced by the catalyst to gases containing less than 100 ppm N_2O and no H_2 . Less than 50 ppm NO was found in the effluent

gas. The presence of higher oxides of nitrogen and acetylene does not decrease the activity of the catalyst. Under comparable conditions a palladium catalyst requires temperatures up to 114°C higher than a rhodium catalyst, and a platinum catalyst 270°C higher. The decomposition of N_2O over rhodium tends to follow first-order kinetics with an activation energy of +23.2 kcal/mole. (auth)

12515 CNI-7

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

ASPETTI CHIMICI E PROSPETTIVE DELLA IRRADIAZIONE GAMMA NEI PROCESSI E PRODOTTI DELL'INDUSTRIA PETROLIFERA. (Chemical Aspects and the Future of Gamma Irradiation in Processes and Products of the Petroleum Industry.) A. Girelli. Feb. 1959. 45p.

Recent work of commercial interest (both immediate and future) carried out by research laboratories of the petroleum industry (refining and petrochemistry) on chemical effects of nuclear radiations on individual petroleum compounds, and on intermediate and finished products of the petroleum industry was reviewed with special emphasis on gamma rays. Gamma rays will undoubtedly find eventual use on a commercial scale to effect chemical processes, including the petroleum refining field. Technological and economical difficulties will limit, at least at the earlier stage of development, the application of gamma radiation to special processes dealing with limited amounts of materials. (auth)

12516 UCRL-8703

California. Univ., Berkeley. Lawrence Radiation Lab. THE RADIOCHEMISTRY OF THORIUM. E. K. Hyde. Apr. 1959. 86p. Contract W-7405-eng-48. \$15.30(ph), \$5.40(mf) OTS.

Inorganic, analytical, and radiochemistry of thorium is reviewed. A table of thorium isotopes is given. The features of thorium chemistry of interest to radiochemists include metallic thorium, soluble and insoluble salts and coprecipitation characteristics, complex ions, chelate complexes, extraction of the TTA complex of thorium into organic solvents, and ion exchange behavior. A collection of detailed radiochemical procedures for thorium is given. (J.E.D.)

12517 CEA-tr-R-616

LA DUALITÉ DE NATURE CHIMIQUE DES ACTINIDES. (The Duality of the Chemical Nature of the Actinides.) E. S. Makarov. Translated into French from Zhur. Neorg. Khim. 3, 1079-88(1958). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 3636.

12518 CEA-tr-R-618

DIAGRAMMES DE SOLUBILITE DES NITRATES D'URANYLE ET DE THORIUM AVEC LES RELARGUANTS. (Solubility Diagrams of Uranyl and Thorium Nitrates with Salting out Agents.) A. G. Kurnakova and A. V. Nikolaev. Translated into French from Zhur. Neorg. Khim. 3, 1028-36(1958). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, abstract No. 15345.

12519 CEA-tr-R-620

MÉCANISME DE LA MIGRATION DES RADIO-ISOTOPES FORMES LORS DE LA DESINTEGRATION

α . (Mechanism of the Migration of Radioisotopes formed during α Disintegration.) V. I. Baranov, A. M. Babeshkin (Babechkine), and K. B. Zaborenko (Zavorenko). Translated into French from Zhur. Neorg. Khim. **3**, 2200-9(1958). 28p. (Includes original, 11p.)

The laws governing the accumulation and distribution, in a solid body, of radioisotopes formed by alpha disintegration and the effect of the distribution on the transfer of the radioisotope into solution were studied. A mechanism of accumulation and distribution of recoil atoms in the solid phase is proposed. The effect of various factors on the transfer of radioisotopes from the solid phase to the liquid phase was investigated using radium isotopes as an example. The experimental results are in agreement with the mechanism proposed. (tr-auth)

12520 CEA-tr-R-625

ETUDE DE LA COPRÉCIPITATION PAR LA MÉTHODE DE TITRAGE RADIOMÉTRIQUE. (Study of Coprecipitation by the Method of Radiometric Titration.) I. P. Alimarin (Alimarine) and I. A. Sirotina. Translated into French from Zhur. Neorg. Khim. **3**, 1709-13(1958). 12p.

The precipitation of silver, thallium, and lead by iodides, chlorides, thiocyanates, chromates, and sulfides was studied in the presence of the radioisotopes Tl^{204} , Ag^{110} , and Pb^{212} . Silver and thallium can be determined as iodides in the same solution and lead and silver as chromates with Tl^{204} as tracer in the first case and Ag^{110} as tracer in the second case. (J.S.R.)

12521 CEA-tr-R-626

SUR LES MÉTHODES PERMETTANT D'ÉTABLIR LE MÉCANISME DE LA COPRÉCIPITATION DES RADIO-ÉLÉMENTS AVEC DES SELS PEU SOLUBLES. (The Methods Permitting the Establishment of the Mechanism of The Coprecipitation of Radioelements with Slightly Soluble Salts.) A. P. Ratner. Translated into French from Zhur. Obshchei Khim. **26**, 949-51(1956). 10p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 98.

12522 CEA-tr-R-635

PRÉPARATION DU GERMANIUM RADIOACTIF AU POINT DE VUE RADIOCHIMIQUE. (Purely Radiochemical Preparation of Radioactive Germanium.) A. N. Baraboshkin. Translated into French by B. de Trezvinsky from Zhur. Neorg. Khim. **2**, 2680-1(1957). 6p.

Radioactive germanium, produced commercially, is not radiochemically pure as several percent of the activity is caused by impurities. Two methods of purification were tested. The first method consists of the precipitation of germanium bisulfide from a sulfuric acid solution and the dissolution of the precipitate by ammonia solution. The precipitation is repeated. The second method consists of the distillation of germanium tetrachloride from hydrochloric acid solution. This method is discussed in detail. Both methods yield a radiochemically pure product of Ge^{71} . (J.S.R.)

12523 CEA-tr-R-637

ETUDE DES OXALATES COMPLEXES DE Pu PAR POLAROGRAPHIE. (Study of Pu Oxalate Complexes by Polarography.) V. V. Fomin, C. P. Vorol'ev, and M. A. Andreeva. Translated into French by B. de Trezvinsky from Atomnaya Energ. **4**, 57-62(1958). 20p.

This paper was previously abstracted from the

original language and appears in NSA, Vol. 12, as abstract No. 8377.

12524

SOME ASPECTS OF THE ELECTROCHEMISTRY OF RADIOELEMENTS. D. Ștefănescu and M. Mihalcu. Acad. rep. populare Romîne, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz. **8**, 491-509(1957). (In Rumanian)

12525

NEUTRON ACTIVATION ANALYSIS OF ROCK AND ORE CONCENTRATE SPECIMENS. D. I. Leipunskaia, Z. E. Gauer, and G. N. Flerov. Atomnaya Energ. **6**, 315-20(1959) Mar. (In Russian)

A method is suggested for determining concentrations of Al, In, Mn, and V in complex ores. A short-life isotope of the investigated material is used as an indicator. The high sensitivity and precision of the method is stressed. (tr-auth)

12526

EFFECT OF THALLIUM(I) IONS ON THE Fe^{3+} REDUCTION BY X RADIATION. J. Bednář (Militár-technische Akademie "Antonín Zápotocký", Brno, Czechoslovakia). Collection Czechoslov. Chem. Commun. **24**, 1006-7(1959) Mar. (In German)

In the investigation of the reduction of ferric ions by x rays with a maximum energy of 150 kev in the presence of α, α' -dipyridyl it was established that the thallium ion greatly affects the reduction yield. The $G_{Fe^{3+}}$ value was calculated from the dependence of the amount of ferrous ions formed on the irradiation time. The results are tabulated and show that the presence of oxygen reduces the irradiation yield. The possible mechanism of the reduction is discussed. (J.S.R.)

12527

THE ROLE OF OXYGEN IN THE RADIOLYTIC BLEACHING OF AQUEOUS INDIGO CARMINE SOLUTIONS. A. A. Zansokhova, V. D. Orekhov, and M. A. Proskurnin. Doklady Akad. Nauk S.S.S.R. **125**, 577-9(1959) Mar. 21. (In Russian)

The importance of oxygen in indigo carmine oxidation was studied by introducing conjugated acceptors and by alternating the doses and other factors (oxygen pressure, pH, etc.). The indigo carmine was subjected to double recrystallization in water and sulfuric acid. All solutions were prepared by double distillation. (R.V.J.)

12528

ON THE THEORY OF RADIATION CHEMISTRY. L. S. Polak and A. Ya. Temkin (Inst. of Petroleum Chemical Synthesis, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. **125**, 584-7(1959) Mar. 21. (In Russian)

Interactions of tracks and the method of approximation calculation of free radicals and finite products of γ and β radiolysis were studied. (R.V.J.)

12529

RADIOCHEMICAL POLYMERIZATION OF STYRENE IN AQUEOUS SUSPENSION. Adolphe Chapiro and Naruo Maeda. J. chim. phys. **56**, 230-3(1959) Feb. (In French)

The radiochemical polymerization of styrene in aqueous suspension was studied using polyvinyl alcohol as the dispersing agent. The conversion curves obtained with three intensities of gamma radiation are linear up to 60% conversion. The slope of the curves is proportional to the radiation intensity to the 0.65 power. The polymer formed includes an insoluble fraction whose importance decreases with the conversion. The average

molecular masses of the soluble polymer fraction remain constant during the reaction and are inversely proportional to the square root of the intensity. These results are compared with results obtained previously during the study of the radiochemical polymerization of styrene in mass. From these data the value of the radiochemical yield for the beginning of chains was determined to be of the order of 2 to 4. The mechanism of the radiochemical polymerization in suspension is discussed. (tr-auth)

12530

ISOTOPIC COMPOSITION OF BORON AND ITS ATOMIC WEIGHT. W. J. Lehmann and I. Shapiro (Olin Mathieson Chemical Corp., Pasadena, Calif.). *Nature* **183**, 1324 (1959) May 9.

After an intensive investigation the conclusion was reached that a boron-11/boron-10 ratio of 4.00 approaches the true natural abundance ratio much more closely than the presently accepted value of 4.31. The latter figure is based on a mass spectrometric investigation of boron trifluoride. Abundance ratios calculated by various investigators from mass spectra of boron hydrides have been highly consistent, yielding ratios of approximately 4.00. The acceptance of the above value would require a revision of the atomic weight from 10.82 to 10.811. (A.C.)

12531

THE SZILLARD CHALMERS EFFECT IN THE γ -QUANTUM IRRADIATION OF CHROMATES AND BICHROMATES. D. K. Popov (Zhdanov Leningrad State Univ.). *Zhur. Fiz. Khim.* **33**, 405-10 (1959) Feb. (In Russian)

The possibility of concentrating Cr^{48} formed from the alkaline metal and ammonium chromates and bichromates in line with the reaction $\text{Cr}^{60}(\gamma, n)\text{Cr}^{48}$ has been demonstrated. The enrichment factor is $> 10^4$. The retention factor in the irradiated solid preparations depends upon the time passing from the dissolution of the salt and the isolation of the Cr^{48} on iron hydroxide, whereas on irradiating aqueous solutions the retention is always of zero value. On dissolution of the irradiated crystals the unstable valence forms of chromium are distributed between Cr^{3+} and Cr^{6+} . (auth)

12532

THE RADIATION OXIDATION OF NITROGEN. IV. TEMPERATURE DEPENDENCE AND THE PART PLAYED BY IONS IN THE REACTION UNDER THE ACTION OF FAST ELECTRONS. M. T. Dmitriev and S. Ya. Pshezhetskii (Karpov Moscow Inst. of Physics and Chemistry). *Zhur. Fiz. Khim.* **33**, 463-70 (1959) Feb. (In Russian)

A study was made of the oxidation of nitrogen at atmospheric pressure and temperatures from 0 to 200°C, on irradiation by fast electrons with energies up to 200 kev. The reaction is of the second order. The activation energy is 1.3 to 1.7 kcal/mole. The steady-state concentration of NO_2 at 1 atm pressure and a temperature of 40° is about 6%. With concentrations up to 2% the NO_2 formed is proportional to the duration and intensity of the irradiation. The effect of the removal of ions from the reaction zone was investigated. The results obtained confirm the proposition made earlier that the oxidation reaction is determined by the ionization of nitrogen and the recombination and neutralization of ions. The temperature dependence of the recombination of the ions was determined. The reaction yield at pressures of 1 atm in a mixture of the composition of air increases

from 1.3 to 3.5 molecules NO_2 per 100 ev on raising the temperature from 20 to 250°C. (auth)

12533

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 29. CHEMICAL EFFECTS OF RADIATION. Geneva, United Nations, 1958. 481p. \$14.50.

The papers presented at this session of the conference were on the following subjects; irradiation of water and aqueous solutions, irradiation of organic substances and solutions, irradiation of polymers, irradiation of various materials, general studies, utilization of fission product energy, and radiation sources. (W.L.H.)

12534

HOT LABORATORY EQUIPMENT. Second Edition. L. G. Stang, Jr., comp. Washington, D. C., U. S. Atomic Energy Commission, 1958. 436p. \$2.50(GPO).

Equipment is described and illustrated which was designed for use in handling radioactive materials. Descriptions are included of facilities, equipment, and accessories for handling moderate to large amounts of radioactive materials. Standard commercially available items designed for nonradioactive applications which have been modified for hot laboratory use are included. The equipment listed includes enclosures for radioactive operations, viewing equipment, manipulators, accessories, chemical processing equipment, in-process fluid transfer devices, equipment for measuring chemical and physical properties, machine tools, materials-handling equipment, monitoring and decontamination equipment, irradiation facilities, special protective clothing, and shielding materials. (C.H.)

Separation Processes for Pu and U

12535 AERE-C/R-816

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CHEMISTRY OF RUTHENIUM. PART I. THE FORMATION AND EXAMINATION OF AN EXTRACTABLE RUTHENIUM NITRATE IN MACROSCOPIC AMOUNTS. PART II. THE EFFECT OF FERROUS SULPHAMATE TREATMENT. F. S. Martin and G. M. Gillies. Dec. 10, 1951. Decl. Apr. 30, 1959. 23p.

The formation in macroscopic quantities of an extractable ruthenium compound from Ru(IV) hydroxy nitrate and nitrous acid is described. It obeys the simple partition coefficient law, with partition coefficient into cyclo-hexanone of 2.3. Twelve hour contact with the solvent converts it to a compound of partition coefficient 13. The possible existence of this and other forms of ruthenium nitrate in plant solutions is discussed. The effect on the extractability of the compound of heating with ferrous sulfamate is shown to reach a maximum in two hours at 90°C in 0.5N nitric acid. Other reducing agents produce the same effect but differ in efficiency. The treatment does not result in reduction of the ruthenium atom in the molecule and it is concluded that the treatment is effective as a result of interaction with the nitroso group which is believed to be present. (auth)

12536 CF-59-2-61

Oak Ridge National Lab., Tenn.
PROCESSING OF MOLTEN SALT POWER REACTOR

FUEL. D. O. Campbell and G. I. Cathers. Apr. 1, 1959. 18p. Contract [W-7405-eng-26]. \$3.30(ph), \$2.40(mf) OTS.

Fuel reprocessing methods are being investigated for molten salt nuclear reactors which use LiF-BeF₂ salt as a solvent for UF₄ and ThF₄. A liquid HF dissolution procedure coupled with fluorination has been developed for recovery of the uranium and LiF-BeF₂ solvent salt which is highly enriched in Li⁷. The recovered salt is decontaminated in the process from the major reactor poisons; namely, rare earths and neptunium. A brief investigation of alternate methods, including oxide precipitation, partial freezing, and metal reduction, indicated that such methods may give some separation of the solvent salt from reactor poisons, but they do not appear to be sufficiently quantitative for a simple processing operation. Solubilities of LiF and BeF₂ in aqueous 70 to 100% HF are presented. The BeF₂ solubility is appreciably increased in the presence of water and large amounts of LiF. Salt solubilities of 150 g/liter are attainable. Tracer experiments indicate that rare earth solubilities, relative to LiF-BeF₂ solvent salt solubility, increase from about 10⁻⁴ mole % in 98% HF to 0.003 mole % in 80% HF. Fluorination of uranium from LiF-BeF₂ salt was demonstrated. This appears feasible also for the recovery of the relatively small concentration of uranium produced in the LiF-BeF₂-ThF₄ blanket. A proposed chemical flowsheet is presented on the basis of this exploratory work as applied to the semicontinuous processing of a 600 Mw power reactor. (auth)

12537 HW-48141

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE REMOVAL OF CESIUM-137 AND STRONTIUM-90 FROM SCAVENGED BISMUTH PHOSPHATE SOLUTIONS. J. R. McHenry. Feb. 7, 1957. 16p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

The passage of a scavenged first-cycle waste solution through a soil representative of the Hanford project reduced the Sr⁹⁰ content of at least five column volumes of effluent solution below the detection limits for the analytical procedures employed. This reduction was effected equally well in synthetic and process bismuth phosphate waste solutions. The removal of Cs¹³⁷ from a first-cycle waste solution, synthetic or process, by passage through a column of a representative Hanford project soil was less efficient than for Sr⁹⁰. A breakthrough of Cs¹³⁷ was obtained generally within one to four column volumes of effluent. The concentration of Cs¹³⁷ in the influent solutions usually was of the same order of magnitude as the Handbook 52 MPC for drinking water. Consequently the relatively high C/C₀ values for Cs¹³⁷ in the effluents represented concentrations of less than one-tenth the MPC value. The volume of scavenged first cycle waste solution which may be disposed safely to ground is dependent on the Cs¹³⁷ content of the waste in question. Three, and perhaps five, column volumes of the scavenged bismuth phosphate waste solution can be disposed to ground. To date all available field data corroborate laboratory estimates of the removal of Cs¹³⁷ and Sr⁹⁰ from scavenged bismuth phosphate waste solutions by soil. (auth)

12538 HW-57573(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CALIBRATION OF THE H-7 METAL SOLUTION BLENDING TANK. C. G. Hough. Sept. 24, 1958. 8p.

Contract [W-31-109-Eng-52]. \$1.80(ph), \$1.80(mf) OTS.

Data for calibrating the H-7 vessel were taken and consisted of standard manometer readings paired with corresponding volume measurements. (W.L.H.)

12539 HW-59283(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE USE OF TETRAVALENT URANIUM AND HYDRAZINE AS PARTITIONING AGENTS IN SOLVENT EXTRACTION PROCESS FOR PLUTONIUM AND URANIUM. J. S. Buckingham, C. A. Colvin, and C. A. Goodall. Feb. 1, 1959. Decl. with deletions Mar. 23, 1959. 14p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

A study of the oxidation-reduction potentials for plutonium and various reducing agents indicates that hydrazine, tetravalent uranium, and ferrous ion have the potential to reduce all valence states of plutonium. It was demonstrated that tetravalent uranium nitrate can be used to reduce plutonium to the trivalent state and hence can be separated from uranium by solvent extraction. (J.E.D.)

12540 IDO-14453

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

IDAHO CHEMICAL PROCESSING PLANT TECHNICAL PROGRESS REPORT FOR APRIL THROUGH JUNE 1958. C. E. Stevenson. Nov. 5, 1958. 69p. Contract AT(10-1)-205. \$2.00(OTS).

Processing of uranium-aluminum alloy was continued with slight process modifications. Means for recovering rare gases from dissolver off-gas are described. Results of extensive decontamination procedures required to enable entrance to the continuous dissolver cell are also indicated. Pilot plant studies of dissolving aluminum continuously showed that rates of dissolution were decreased by factors of 2 to 4 as the concentration of nitric acid fed was increased from 5.4 to 11N. The rate of aluminum dissolution was found to be proportional to initial area exposed for pieces of different shape. It was found possible to produce a highly basic aluminum nitrate solution at a reasonable rate by dissolving to low concentration in dilute acid, followed by evaporation to the desired level. Uranium exchange rate measurements for the TBP extraction process are described. A canned rotor pump under test with graphite bearings operated 6000 hours with nominal wear. Difficulties were experienced in testing a nutating disc pump. Measurements of the potential of zirconium in hydrofluoric acid as a function of pH confirmed the predicted equation. In teflon vessels, zirconium dissolves a little more rapidly in nitric-hydrofluoric acid mixtures than in glass vessels, presumably due to reaction of fluoride with silica. Titanium alloy Types 55A and 75A were found to resist corrosion by certain boiling nitric-hydrochloric acid mixtures. Initial tests have commenced with a NaK-heated 100 liter/hour pilot plant aluminum nitrate calciner to continue process demonstration. In tests in the smaller pilot plant unit, increasing feed spray air ratio was found to increase particle loading in the cyclone effluent. Laboratory studies indicated that a venturi scrubber using dilute nitric acid at 80°C should remove ruthenium effectively from calciner off-gas. In a pilot plant test in which a significant fraction of ruthenium feed was retained by the alumina, substantial absorption of volatilized ruthenium was obtained. Thermal conductivity of alumina

near 3000°F was about 0.26 Btu/(hr)(ft)(°F). In leaching studies, very little strontium or plutonium was removed by water from alumina calcined at 550°C. Dilute nitric acid, however, extracted strontium from this material to the same degree (~50 percent) as from material calcined at 400°C. Concentrated basic aluminum nitrate was produced from simulated aluminum nitrate waste by slow hydrolysis with urea followed by evaporation. Aluminum was efficiently extracted from buffered aluminum nitrate solution by acetylacetone and was stripped back into nitric acid. A filterable aluminum phosphate was precipitated from aluminum nitrate solution by urea hydrolysis; the phosphate effectively carried fission products, however. Spectrophotometric methods were developed for macro and micro quantities of uranium, in the presence of high concentrations of other ions, based on tetrapropylammonium nitrate extraction. (For preceding period see IDO-14443.) (auth)

12541 ORNL-2235

Oak Ridge National Lab., Tenn.

RECOVERY OF Np^{237} BY THE NEPTX SOLVENT-EXTRACTION PROCESS. J. R. Flanary, J. H. Goode, R. G. Mansfield, and R. P. Wischow. Apr. 3, 1957. Decl. May 6, 1959. 39p. Contract W-7405-eng-26. \$6.30 (ph), \$3.00 (mf) OTS.

Flowsheets are presented for the solvent extraction recovery of uranium and Np^{237} from special highly irradiated MTR fuel elements and from nonvolatile fluoride residues from the Oak Ridge Gaseous Diffusion Plant. In both cases the material containing the neptunium and uranium is dissolved and digested to inactivate emulsion-forming impurities, the neptunium and uranium are extracted with tributyl phosphate solvent, using aluminum nitrate as the primary salting agent, scrubbed free of fission products and/or ionic contaminants, and finally separated and recovered by selective stripping with nitric acid. (auth)

12542 CEA-tr-X-125

SÉPARATION DE L'URANIUM PAR EXTRACTION AU MOYEN D'UNE COLONNE ET ANALYSE QUANTITATIVE PAR PHOTOMÉTRIE. (Separation of Uranium by Extraction in a Column and Quantitative Analysis by Photometry.) T. Hara. Translated into French by E. Hara from *Nippon Kagaku Zasshi* 78, 337-40(1957). 10p.

A method for the extraction of small quantities of uranium is described. It consists in the absorption of the solution containing the uranium by silica. The silica is placed in a separatory funnel containing glass fiber and synthetic silica. Ether is used as uranium eluant. The addition of sodium acetate to the uranium solution improves the reproducibility of the method. The presence of thorium, zirconium, and phosphoric ion interferes with the uranium extraction, and methods of preventing the interference are given. (J.S.R.)

12543

IMPROVEMENTS IN OR RELATING TO METHODS OF SEPARATING URANIUM FROM THORIUM AND PROTACTINIUM. (to United Kingdom Atomic Energy Authority). British Patent 809,282. Feb. 18, 1959.

Separation of U from irradiated $\text{ThO}_2\text{-Th}(\text{CO}_3)_2$ is accomplished using sodium diethyldithiocarbamate. The irradiated material is dissolved in HNO_3 and brought to a pH of 2 or 3. The sodium diethyldithiocarbamate is dissolved in amyl acetate to make a 0.25% solution which is contacted with the nitrate solu-

tion. The U forms a diethyldithiocarbamate salt which remains in the organic phase to the exclusion of Th and Pa. If an organic solvent such as methyl isobutyl ketone is used, some Th is extracted into the organic phase. (T.R.H.)

12544

RECOVERY OF URANIUM FROM ORES THEREOF.

Frank Woods McQuiston, Jr. (to United Kingdom Atomic Energy Authority). British Patent 809,327. Feb. 25, 1959.

A resin-in-pulp process for U recovery from ores is described. The ore is ground, leached with H_2SO_4 , and the leach pulp plus pregnant liquor are exposed to pieces of anion exchange resin which can later be screened out. (T.R.H.)

12545

PRODUCTION OF URANIUM. Archie Edwin Ruehle and John Walker Stevenson (to U. S. Atomic Energy Commission). British Patent 809,408. Feb. 25, 1959.

An improved bomb process for reduction of UF_4 to U is offered. The process differs essentially from the conventional process in that Mg is used as reductant and MgF_2 slag is used as bomb liner. The Mg is added to the UF_4 charge in a stoichiometric excess of 3 to 5% along with an additive which forms a film on the Mg to prevent undesirable and premature reactions. The additive material may be UO_3 , $\text{UF}_4 \cdot 5\text{H}_2\text{O}$, UO_2F_2 , or NaHF_2 . The additive should be ~0.5 to 2.0% of the UF_4 by weight. Alternatively, the Mg may be treated with the additive prior to mixing with the UF_4 . In this alternate procedure the mixture of Mg plus additive is pressed at 10,000 psi into 25 gm wafers. This reduces the firing time without impairing the yield. The MgF_2 slag for the bomb liner is ground so that 75% passes through a 100-mesh screen. The slag powder is then poured into the bomb around a rubber mandrel which is tamped to pack the liner. The rubber mandrel is then lifted out, the charge put in, and the bomb is evacuated for $3\frac{1}{4}$ hours, sealed, and fired. Small metal particles found trapped in the slag are pickled in HNO_3 and recycled. When UO_3 is used as additive, MgO forms in the slag, and as the slag is re-used the MgO content increases. To recondition this slag NaF (~2.5 wt. % of UF_4) is added to the charge. The NaF forms a lower melting slag and gives a shorter reaction time. (T.R.H.)

12546

RECOVERY OF PLUTONIUM. (to United Kingdom Atomic Energy Authority). British Patent 810,541. Mar. 18, 1959.

Separation of Pu from U by precipitation as a PuO_2^{2+} complex with a metal acetate is described. The metal acetate may be Na, Li, Co, Cu, Mn, Ni, Mg, Zn, or Cd. The U and Pu in a HNO_3 solution containing fission products are oxidized by $\text{K}_2\text{Cr}_2\text{O}_7$ and then precipitated by adding CH_3COOMg and CH_3COONa . This precipitate is filtered, washed, and redissolved in HNO_3 . The Pu is then selectively reduced by NaHSO_3 , and the UO_2^{2+} is precipitated out by a second CH_3COONa and CH_3COOMg treatment. Then the filtrate containing Pu is acidified, oxidized, and $\frac{1}{20}$ of the amount of U initially present is added as carrier for another precipitation of Pu by acetate. This precipitation cycle is repeated until the Pu is obtained almost free of U and fission products. Np which accompanies Pu throughout this process later decays to Pu. (T.R.H.)

12547

IMPROVEMENTS IN OR RELATING TO REMOVAL OF RUTHENIUM FROM SOLUTIONS OF METAL NITRATES IN ORGANIC SOLVENTS. Samuel Slater Grimley and Ivor Wells (to United Kingdom Atomic Energy Authority). British Patent 811,771. Apr. 15, 1959.

Ru can be removed from organic $\text{UO}_2(\text{NO}_3)_2$ solutions by an aqueous strip. An organic extract containing $\text{UO}_2(\text{NO}_3)_2$ is contacted with an aqueous solution 0.1 N in HNO_3 , 0.005 M in FeSO_4NH_2 , and 8 M in NH_4NO_3 at 60°C in a countercurrent extraction apparatus. The $\text{UO}_2(\text{NO}_3)_2$ may then be stripped from the organic phase in H_2O or HNO_3 solution. The Ru content of $\text{UO}_2(\text{NO}_3)_2$ separated this way is greatly reduced. (T.R.H.)

12548

IMPROVEMENTS IN OR RELATING TO THE EXTRACTION OF METAL COMPOUNDS FROM AQUEOUS SOLUTIONS. John Molyneux Fletcher (to United Kingdom Atomic Energy Authority). British Patent 811,772. Apr. 15, 1959.

A pretreatment is given which reduces Ru nitroso compounds in HNO_3 solutions, thereby rendering the Ru less soluble in the organic phase during subsequent solvent extraction. Thus, a nitric acid solution containing U, Pu, Ru, and other fission products is treated with FeSO_4NH_2 plus N_2H_4 at 80°C for a period of time depending on the amount of Ru to be reduced. During solvent extraction with cyclohexanone or β , β' -dibutoxydiethyl ether the Ru remains largely in the aqueous phase. (T.R.H.)

12549

URANIUM RECOVERY FROM ORES. (to United States Atomic Energy Commission). British Patent 811,890. Apr. 15, 1959.

A process for separating U from Western ores by acetone extraction is described. The ore is ground to finer than -12 mesh and treated with HCl or $\text{HCl}-\text{H}_2\text{SO}_4$. Sufficient HCl should be added to convert CaCO_3 to CaCl_2 and U to UCl_4 . The carbonate content of the ore is optimal at 0.4 to 0.6%. Any acid over the required HCl is concentrated H_2SO_4 . The acidulation step may or may not be accompanied by roasting or an oxidizing agent such as KClO_3 . The amount of water in the system was optimal at 50 to 150 g/l of acetone. In operation of the process, ground acidulated ore is put in the low end of a cylinder with an endless chain drag arrangement. The drags move the ore through a puddle of acetone at the bottom, then through an acetone wash then to an acetone evaporator. The solids settle out immediately giving a clear supernate. The U is recovered from the acetone by NH_4OH precipitation. (T.R.H.)

12550

METHOD OF RECOVERING URANIUM. (to United Kingdom Atomic Energy Authority). British Patent 812,793. Apr. 29, 1959.

A calutron processing scheme is described which includes electrolytic removal of U from collectors. The UCl_4 and other water solubles are removed with hot water washes, sieved, oxidized by H_2O_2 , filtered, evaporated, precipitated with NH_4OH , redissolved in H_2SO_4 , and electrolyzed. This electrolyzed solution is combined with the 0.01 N H_2SO_4 solution in which the collector was electrolyzed to remove metallic U. The U^{4+} is precipitated by NH_4OH and the $\text{U}(\text{OH})_4$ is calcined to UO_2 . The UO_2 is then chlorinated to UCl_4 . (T.R.H.)

CONTROLLED THERMONUCLEAR PROCESSES

12551 AERE-P-17/P-6

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ASPECTS OF THE GAS DISCHARGE PROJECT. P. C. Thonemann. [1955]. Decl. Apr. 30, 1959. 68p.

The features of the British gas discharge project are reviewed. In particular, papers are included on its elementary theoretical aspects. The topics discussed are the elementary theory of the constricted current channel, features of high-current ring discharges, transport equations for high-current discharges, a survey of wriggling discharge, neutral atom density in a constricted discharge, and the radiation from a highly ionized gas. (B.J.H.)

12552 AERE-T/R-1984

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HYDROMAGNETIC INSTABILITIES OF A CYLINDRICAL GAS DISCHARGE. III. INFLUENCE OF STEADY AXIAL MAGNETIC FIELD. R. J. Tayler. July 1956. Decl. Apr. 30, 1959. 26p.

A method used in attempting to stabilize a toroidal gas discharge has been the application of an axial magnetic field before the contraction of the current channel. Using such a field, a high degree of stability was obtained. The theory of a simplified cylindrical model of such a discharge is considered, and it is found that there is no axial magnetic field which will stabilize all disturbances. Moreover, although differences between theoretical and experimental results are to be expected because of simplifications which must be made in the theory, the main type of instability appears almost to be inherent in any application of a steady axial field. (auth)

12553 ARL-7-60

Space Technology Labs., Inc. Physical Research Lab., Los Angeles.

THE SUPER-GAST LONGITUDINAL PINCH. Burton D. Fried. Nov. 12, 1957. 42p. Contract AF04(647)-127.

The superfast nonadiabatic pinch is a promising method of heating a plasma without violating the conditions necessary for subsequent confinement with a stabilized pinch. An experimental test of the feasibility of a superfast longitudinal pinch at high density is currently in progress. The ideas underlying this concept are reviewed and a simple theoretical model is used for calculations of the results to be expected from these experiments. (auth)

12554 ORNL-2693

Oak Ridge National Lab., Tenn.

THERMONUCLEAR PROJECT SEMIANNUAL REPORT FOR PERIOD ENDING JANUARY 31, 1959. May 18, 1959. 127p. Contract W-7405-eng-26. \$2.75(OTS).

Neutral particle collection, microwave equipment, and mathematical approximations were used in studies of the DCX plasma. Measurements of decay times and the spatial extent of plasmas trapped in DCX were attempted. One microwave measurement of a deuterium plasma gave brief indications of a plasma density of 1×10^{11} electrons/cm³. Single ion orbits in the azimuthally symmetric DCX magnetic field in the absence of collisions

were studied with the aid of the ORACLE. Linearized Vlasov equations were used in a study of small-amplitude oscillations of a quasi-neutral plasma in a uniform, time-independent, externally produced magnetic field. Spectroscopic studies of the 5-ft-long, 300-amp carbon arc showed Doppler broadening corresponding to ion motions with kinetic energy of 50 ev. First results of a mass spectrometric analysis of a short carbon arc verify spectrographic evidence of existence of triply ionized carbon in the arc. Microwave measurements, for an arc current of 300-amp and a magnetic field of 2600 gauss, tentatively established that the plasma frequency of the arc is $\sim 140,000$ Mc. An attempt to determine the floating potential distribution in the carbon arc with an axially movable potential probe is described. Electromagnetic radiation from a 3- to 6-ft-long, magnetically constrained, vacuum carbon arc was studied with specially designed circular-foil radiometers. PIG-type ion sources were studied for possible application to DCX. Three models of oil diffusion pumps were tested, and no significant difference in their performance was noted. A 50-ft-long carbon arc assembly is being constructed for studies of the higher ion energies believed to be associated with increasing arc length. A multistage grid source is being designed which should produce a 600-kev beam. A study of the sputtering effect of argon, helium, and deuterium ions on copper and aluminum was undertaken. The wettability of some base materials by an In-Ga-Sn eutectic alloy considered for use in a liquid-metal seal was tested at temperatures up to 450°C . A vacuum furnace with a hot zone 26 in. in diameter was constructed. Failure of the copper tubing used for heating and cooling the DCX liner with steam and water was shown to be accompanied by intergranular defects. Design and construction was completed on a new type of vacuum spectrometer to be used in the study of carbon arcs and H and D plasmas. A circuit for semilogarithmic photometric recording was developed. Work in progress or completed by the engineering science group is summarized. A flexible ORACLE code to permit rapid calculation of magnetic fields and vector potential for use in coil design problems for DCX-2 was developed. (W.D.M.)

12555 RISÖ-6

Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø.

ON THE OPTIMIZATION OF THE TRITIUM ENRICHMENT WITH RESPECT TO THE ENERGY BALANCE IN STEADY STATE THERMONUCLEAR REACTIONS.

T. Hesselberg Jensen. Aug. 1958. 10p.

The energy balance is investigated for high tritium enrichments and an optimum enrichment is found. The results found for the steady state case are also approximately correct for a pulsed system. For a pulsed system the product of the deuterium density and the pulse time is an interesting parameter, which can be used instead of the burn up. A parameter for the steady state system, corresponding to the density time product for the pulsed system, is therefore of interest. It is found that the optimum value of this parameter is remarkably constant for temperatures and enrichments of interest. (auth)

12556 UCRL-4231(Del.)

California. Univ., Livermore. Radiation Lab.
SIXTEEN LECTURES ON CONTROLLED THERMONUCLEAR REACTIONS. R. F. Post. Feb. 2, 1954. Decl. with deletions Apr. 9, 1958. 143p. Contract W-7405-eng-48. \$2.75(OTS).

A compilation is made of the material presented in a

series of 16 lectures given during Oct., Nov., and Dec. at UCRL. The lectures dealt primarily with the theory of operation of a proposed thermonuclear reactor using the so-called "magnetic mirror" principle. Plasma injection, containment, and heating are specifically dealt with. (W.D.M.)

12557

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 31. THEORETICAL AND EXPERIMENTAL ASPECTS OF CONTROLLED NUCLEAR FUSION. Geneva, United Nations, 1958. 396p. \$15.00.

Papers from sessions 4, A-5, and A-6 on the possibility of controlled fusion, theoretical aspects of plasma physics, and experimental aspects of plasma physics are presented. (W.D.M.)

12558

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 32. CONTROLLED FUSION DEVICES. Geneva, United Nations, 1958. 470p. \$15.00.

The edited papers from sessions A-7, A-9, and A-10 on controlled fusion devices and instrumentation in fusion are presented. (W.D.M.)

GEOLOGY AND MINERALOGY

12559 NYO-7906

Pennsylvania State Univ., University Park. Mineral Industries Experiment Station.

AN INVESTIGATION OF THE MINERALOGY AND PETROGRAPHY OF URANIUM-BEARING SHALES ANALYTICAL PROCEDURES APPLICABLE TO FINE-GRAINED SEDIMENTARY ROCKS. Robert L. O'Neil. Mar. 21, 1958. 37p. Contract AT(30-1)-1202. \$6.30 (ph), \$3.00(mf) OTS.

Methods are described for the determination of major and minor chemical constituents in fine-grained sedimentary rocks. They include wet-chemical, radiometric and flame-photometric methods, as well as absorption and emission spectroscopic and fluorescent x-ray procedures. The major elements are determined by a rapid semimicromethod on two samples, one of which is decomposed by fusion with sodium carbonate, the other by digestion with sulfuric and hydrofluoric acids. Trace elements are determined by spectrochemical procedures using internal standards. Carbon, sulfur and the carbon present in carbonate minerals are determined by conventional methods. A fluorescent x-ray spectroscopic method for iron and molybdenum is described. (auth)

12560 RME-2080

Grand Junction Operations Office. Salt Lake Branch Office, AEC.

SUMMARY OF THE AIRBORNE RADIOMETRIC SURVEY OF THE SOUTHERN CALIFORNIA PROJECT, SOUTHEASTERN CALIFORNIA AND SOUTHWESTERN ARIZONA. Alexander M. Peterson. July 1956. 10p. \$0.50(OTS).

In 1955-1956, six months of airborne operation were required to radiometrically survey the Southern California project. This project area is located in south-

eastern California and southwestern Arizona. Precambrian schists, gneiss, granite; Paleozoic sediments and metasediments; Mesozoic intrusives, metasediments; and Tertiary sediments and volcanics constitute the rock types flown. A total of 142 hours and 20 minutes of rim flying was conducted during which 24 anomalies were detected. Of these anomalies six carry uranium minerals but occurred on claimed ground at the time of this survey. Eleven of the 24 anomalies also occurred on claimed ground but were not ground checked for uranium minerals. Seven anomalies occur on public domain but ground investigations failed to reveal any uranium minerals on the most promising of them. None of these anomalies was posted for public inspection. A 135-horsepower, 2-place, fixed-wing airplane equipped with an airborne scintillation counter was used in this survey. (auth)

12561

OPAQUE RUTILE. A. V. Rudneva and T. Ya. Malysheva (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* 125, 363-5 (1959) Apr. 11. (In Russian)

The optical characteristics of mixed crystals of Ti_2O_3 in TiO_2 are studied. (R.V.J.)

12562

RESPONSE OF DYKE TO OSCILLATING DIPOLE. James Paul Wesley (Newmont Exploration, Ltd., Danbury, Conn.). *Geophysics* 23, 128-33(1958) Jan.

A dyke of sulfide ore may be geophysically prospected by observing its electromagnetic response to a slowly oscillating magnetic dipole source. An excellent first approximation of the fields generated is obtained by considering the idealized case of a dyke of infinite conductivity and vanishing thickness in a vacuum. Surprisingly, this idealized problem can be solved exactly in terms of a newly discovered Green's function for Laplace's equation (in three dimensions) which is simply expressed in closed form. The magnetic scalar potential and the magnetic field are given for final results. (auth)

12563

RECONNAISSANCE INVESTIGATION OF URANIUM OCCURRENCES IN THE SARATOGA AREA, CARBON COUNTY, WYOMING. James G. Stephens and M. J. Bergin. *U. S. Geol. Survey Bull.* 1046-M. 22p., and 2 illus. \$0.55(GPO).

Uranium occurs in the Browns Park(?) formation of Miocene(?) age, the North Park(?) formation of Pliocene(?) age, and Quaternary pediment gravels in the Saratoga area, Carbon County, Wyo. No commercial deposits have been found to date. Carnotite, $\text{K}_2(\text{UO}_2)_2(\text{VO}_4)_2 \cdot 1-3\text{H}_2\text{O}$, the only uranium mineral identified in the area, was found at two localities. It occurs in pediment deposits as a coating on individual cobbles and boulders and as disseminated specks in fine-grained material. Directly below the pediment gravel, carnotite is found as a caliche-like coating on limestone and sandstone. At 30 other localities the uranium is disseminated as a mineralogically unidentifiable form in chert, limestone, sandstone, siltstone, carbonaceous shale, or volcanic ash. The highest concentration of uranium (0.027%) was found in chert layers and irregular masses in silicified limestone. A concentration of 0.026% of uranium was found in a silicified volcanic ash bed 0.4 feet thick. A selected sample of pediment gravel containing carnotite analyzed 0.011% of uranium. The carnotite occurrences are be-

lieved to have been formed by solution and redeposition of uranium by ground water. Analyses of rock and water samples collected in the area and generalized descriptions of exposed strata are tabulated. (auth)

HEALTH AND SAFETY

12564 AAEC/E-7

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales. THE ADSORPTION OF RADIOACTIVE IODINE 131 ON MUD. W. R. Ellis and Marion E. Gardner. June 1958. 8p.

The effect of KI carrier concentration on the absorption of I^{131} as iodide on mud is indicated. Results are presented graphically. (J.R.D.)

12565 AE-3

Aktiebolaget Atomenergi, Stockholm. COMPARISON OF FILTER PAPERS AND AN ELECTROSTATIC PRECIPITATOR FOR MEASUREMENTS ON RADIOACTIVE AEROSOLS. R. Wiener. Sept. 1956. 7p.

Measurements were made in which electrostatic precipitators were compared with filter papers for collecting airborne radioactivity for alpha and beta measurements. The results show that the filter paper method is as good as the electrostatic method in determining beta-activity, disregarding clogging and moisture sensitivity of the filter paper, but it is inferior for alpha measurements. Experimental values of the alpha absorption factor for different types of filter papers are given. (auth)

12566 HW-54841(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash. RADIOACTIVE CONTAMINATION IN THE HANFORD ENVIRONS FOR THE PERIOD JULY, AUGUST, SEPTEMBER 1957. M. W. McConiga, J. M. Selby, and J. K. Soldat. Feb. 24, 1958. Decl. with deletions Apr. 2, 1959. 40p. Contract W-31-109-Eng-52. \$6.30(ph), \$3.00(mf) OTS.

A summary is presented of the monitoring results obtained in the Hanford environs for radioactive contamination during July, August, and September, 1957. Counting rates obtained from these analyses were corrected for geometry, backscatter, air window absorption, source size, self-absorption, chemical yield, and collection efficiency. Additional corrections for decay were applied to those samples in which significant amounts of short half-life beta particle emitters were found. (J.R.D.)

12567 KIR-160/56

Norway. Forsvarets Forskningsinstitut, Oslo. FISJONSPRODUKTET I-131 I BIOLOGISK MATERIALE, SPESIELT I MELK. (Fission Product I-131 in Biological Material, Especially in Milk.) H. Bergh. Dec. 1956. 21p. Project No. 239.

The maximum permissible intake of I^{131} was recently set at 0.01 $\mu\text{C/day}$ for infants. This corresponds to maximum permissible concentration in water of $6 \times 10^{-6} \mu\text{C/ml}$ and $6 \times 10^{-9} \mu\text{C/ml}$ in air. A new method for the estimation of I^{131} in milk, makes it possible to detect less than 1/400 part/l of this maximum permissible intake for infants. The method was tested in an experiment giving 700 μC to a cow. The I^{131} secretion of the milk could be traced for 32 days. A few examples of

the use of this method in routine investigations is given. The method can also be used for ^{131}I investigations in biological materials such as urine, feces, and thyroid glands. (auth)

12568 NRL-Memo-758

Naval Research Lab., Washington, D. C.
PROCEDURE FOR THE SEQUENTIAL RADIOCHEMICAL ANALYSIS OF STRONTIUM, YTTRIUM, CESIUM, CERIUM, AND BISMUTH IN AIR-FILTER COLLECTIONS. R. A. Baus, P. R. Gustafson, R. L. Patterson, Jr., and A. W. Saunders, Jr. Nov. 1957. 24p. Project NR-571-003.

A detailed description is given of the radiochemical procedures and the measuring techniques used at NRL to determine strontium-89 and 90, yttrium-91, cesium-137, cerium-141 and 144, and bismuth-210 in air-filter collections. (auth)

12569 SRIA-3

Stanford Research Inst., Menlo Park, Calif.
FALLOUT CONTROL. Final Report. C. E. Lapple. Aug. 1, 1958. 189p. SRI Project No. SU-2479. Contract AT(04-3)-115.

Following the explosion of a nuclear weapon, a great deal of radioactive material, primarily fission products from the weapon, is introduced into the atmosphere. This material falls or is carried to earth at various times and distances from the time and point of the explosion, much of it being distributed over the entire earth. Some of the radioactive fall-out has a relatively short life; although its intense radiation constitutes the primary hazard at sites close to the point of detonation, it soon decays. It is the widely distributed, long-lived fall-out that constitutes weapons testing's primary somatic hazard to man, because it can be assimilated by vegetation, animals, and humans over vast areas and over long periods of time. The direct human intake of radioactive materials from drinking water, from air, and through the skin is small compared with the indirect intake through foods such as fruits, vegetables, milk, and meat. The ability of at least some forms of vegetation and organisms to concentrate specific elements accounts for the predominant role of vegetation as the major source of human intake of radioactive materials. The fission of uranium-235 and plutonium-239, the two materials in common use in weapons today, results in a wide variety of radioactive materials. The fission yields from both of these materials are very similar, and discussions refer to the fission of uranium-235, since most of the interpretative information in the literature has been given for uranium-235. Of the fission products, only strontium-90, and to a lesser extent cesium-137, are of direct biological concern. Neither material is found to any significant extent as a primary fission product but are the product of decay of one or more precursors. Strontium-90 and cesium-137 are considered to be the most hazardous fission products because of their long lives and relatively high emission rates. Of these, strontium-90 is considered the most dangerous. Because of its similarity to calcium, it tends to concentrate in the bone structure rather than being excreted quickly, and hence has a relatively long biological life. For most populations the bulk of the strontium-90 enters man through milk and dairy products, which in turn reflect the transfer of strontium-90 from vegetation to the cow. The origin, types, and destiny of radioactive fall-out are outlined. Basic data on fall-out are reviewed. The entry and biological hazards of strontium-90 in the human

food-chain are discussed. The feasibility is considered of various conceivable control measures for fall-out which may be applied to the fireball or cloud during weapons testing. Suggestions are included for a program for experimentally developing additional information necessary for the assessment of control measures. Data are appended on the terminal settling velocities and diffusion coefficients for aerosol particles, vapor pressure and melting points for various compounds, fission product decay relationships, diffusion growth and deposition of particles, and particle scavenging. 1101 references. (C.H.)

12570 WT-1497

Food and Drug Administration, Washington, D. C. and Federal Civil Defense Administration, Washington, D. C.

EFFECT OF FALLOUT CONTAMINATION ON RAW AGRICULTURAL PRODUCTS. Harold V. Leininger, Edwin P. Laug, Raymond D. Chapman, Homer J. McConnell, Alan T. Spiher, and Stephen E. Koelz. Mar. 1958. 16p. Project 38.2 of OPERATION PLUMBBOB. \$0.50(OTS).

Wheat, dried fruits, snapped corn (unhusked), soya beans, cotton seed, and potatoes were exposed to moderate contamination resulting from fallout under actual field conditions. It was found that water washing as applied to dried fruits, soya beans, and cotton seed was relatively ineffective in removing fallout contamination; scrubbing potatoes, followed by removal of the skins, was effective. The protecting layers of husk around ears of corn prevented the contamination of the grain inside. A complete milling operation on fallout-exposed wheat showed that a considerable amount of contamination could be removed by cleaning operations as well as by separation of the bran. Flour resulting from such contaminated wheat exhibited relatively low residual radioactivity. Because of the low degree of contamination of the wheat, caution should be used in extrapolating these results to more severe situations. (auth)

12571

HEALTH HAZARDS ASSOCIATED WITH ROLLING NORMAL AND ENRICHED URANIUM—EVALUATION AND CONTROL. Edwin C. Hyatt (Los Alamos Scientific Lab., N. Mex.). *Am. Ind. Hyg. Assoc. J.* 20, 82-91 (1959) Apr.

Industrial health surveys have been made over a period of 5 years during rolling operations with normal uranium at LASL and at two off-site plants. The results indicated that personnel participating in this work were not exposed to above-tolerance levels of external or internal radiation hazards. The external radiation hazards were evaluated by means of personnel film badges. The internal hazards from alpha active particles were measured by means of air and urine samples. The exposure at LASL during normal uranium rolling (with adequate ventilation) never exceeded 10% of tolerance. During hot rolling (primary) operations at an off-site plant, with inadequate or no ventilation, personnel were exposed to levels of air-borne contamination above daily tolerance levels for short periods of time. During warm rolling (secondary) operations with normal uranium at a second off-site plant, exposures were less than 10% of daily tolerance levels. Industrial health surveys have been made during enriched uranium rolling operations at LASL. These rolling operations were performed in a workroom with ventilation designed for normal uranium operations. Results of air sampling indicate personnel

were exposed to air concentrations above tolerance for short periods of time. Results of urine analysis showed the average exposures never exceeded 20% of tolerance. Hot rolling from salt baths presents the greatest hazards. Hazards during warm rolling from oil baths are minimal. Recommendations are given for the control of health hazards. (auth)

12572

SURFACE CONTAMINATION CONTROL WITH URANIUM ROLLING OPERATIONS. Charles D. Blackwell (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 20, 92-8(1959) Apr.

The problems encountered during uranium rolling were found to be more of a technical nature than one of great health hazard. The considerations for enriched uranium were found to be essentially the same as for normal uranium except for the magnification of specific activity levels. Strip heating of uranium and rollers resulted in the least amount of contamination spread, with the exception of wiper blades. Heating uranium in an oil bath prior to rolling resulted in the second least contamination spread, and salt bath and furnace heat methods resulted in the greatest amount of contamination spread. Work clothing issue and change room facilities reduce contamination to personnel as well as confining contamination activity within the plant. Personnel must be monitored for contamination as they leave the area both as a health check and also to indicate a trend on operating controls. It has been found that waste water from such areas has not exceeded the drinking water tolerance providing it has been properly filtered. Contaminated clothing must be processed by laundry facilities segregated from those handling ordinary clothes. Shearing operations created more problems than rolling since the material had to be handled longer while it was being sheared. This operation results in the greatest external radiation to the body, in addition to creating high airborne contamination, unless adequate ventilation is provided directly at the shears. Contaminated residue had to be placed in containers and disposed of in accordance with AEC and local requirements. Frequent surface monitoring was the key to contamination control. With the exercise of proper contamination and fire control, the hazard encountered by personnel was nil. (auth)

12573

PARTICLE SIZE STUDIES ON URANIUM AEROSOLS FROM MACHINING AND METALLURGY OPERATIONS. E. C. Hyatt, W. D. Moss, and H. F. Schulte (Los Alamos Scientific Lab., N. Mex.). Am. Ind. Hyg. Assoc. J. 20, 99-107(1959) Apr.

Cascade impactors and optical measurements were used to estimate the particle size distribution of uranium aerosols that were dispersed during machining and various metallurgical operations. The mass median diameter of air-borne foundry dust ranged from 2.0 to 4.5 μ . The largest mass median diameter range determined by cascade impactors was 0.4 to 3.9 μ in the machine shop. This was expected owing to the nature of the machining on uranium. The number median diameter on uranium fume calculated from the mass median diameter and the standard deviation ranged from 0.02 to 0.05 μ . The number median diameter on U_3O_8 resulting from furnace oxidation of uranium metal slag was measured from electron micrographs and found to be 0.08 μ . The cascade impactor has definite limitations in its use, although no satisfactory substitute has been available

for field use. Fair agreement was obtained between mass median diameter values obtained at specific operations on both normal and enriched uranium. Normal uranium dust may be sized optically, but it would be impossible to size enriched uranium dust optically on field samples due to the small mass of enriched uranium compared with the mass of ordinary atmospheric dust collected on the same slides. The estimation of particle size by nuclear track counting and measurement of alpha track emitting particles is considered the best method for enriched uranium dust. Results indicate that mass median diameters obtained with our modification of the Casella impactor show satisfactory agreement with the Laskin impactor data. Differences in the values of the standard deviation have been found in many cases with the Laskin impactor giving better straight line plots and, hence, a more clearly defined value for the standard deviation. (auth)

12574

EVIDENTIARY PROBLEMS IN PROVING RADIATION INJURY. Gerald L. Hutton. (Atomic Energy Commission, Washington, D. C.). Am. Ind. Hyg. Assoc. J. 20, 111-12(1959) Apr.

Legal actions based on radiation injury pose many difficult evidentiary problems which are of interest to the technical expert as well as the lawyer. The technical expert will play an important role in any litigation since, generally, the legal profession has not acquired the language or an understanding of the technology. In any personal injury suit the plaintiff must show that the defendant owed a duty to the plaintiff to exert a certain degree of care, that the defendant failed to exercise that degree of care, and that the defendant's lack of care resulted in damage to the plaintiff. The potential for radiation injury is extensive since more than 5,000 firms are using either reactor produced radioisotopes or naturally occurring radiomaterials, and more than 125,000 x-ray machines are now in use. A few suggestions are presented for the protection of users of radiation against possible litigation. (C.H.)

12575

RADIATION—A PHOTOFLUOROGRAPHIC STUDY. Edward J. Baier (Pennsylvania Dept. of Health, Harrisburg). Am. Ind. Hyg. Assoc. J. 20, 113-17(1959) Apr.

Precautions to be observed during the operation of photofluorographic x-ray equipment are summarized. Results are presented from a survey of installations using such equipment. An evaluation was made of direct x-ray beams, gonadal exposure of subjects, and the exposure of persons in the vicinity of these units. (C.H.)

12576

RADIATION HAZARDS ASSOCIATED WITH DENTAL ROENTGENOGRAPHY. W. E. Nolan and Seymour Block (Univ. of California, Livermore). Am. Ind. Hyg. Assoc. J. 20, 118-20(1959) Apr.

Dental roentgenograms are extremely valuable aids to the dentist. Their value must always be considered more important than the expense of a small local dose. However, where it is possible to reduce the exposure, with negligible diagnostic sacrifice, this must be done. It is strongly urged that corrective educational measures be provided. All accredited dental schools must have, as a required part of their curriculum, a course in radiation protection or equivalent. This training could later be imparted to the dental technician, if necessary. In parallel with this act every manufacturer of x-ray machines must make it a point to provide all

the aforementioned adaptations on their new equipment. If possible all their past customers should be informed of the potential hazards of their machines and recommended corrections initiated. In any event there should be an enthusiastic drive towards putting an end to the needless excessive exposure given to the unwary public. (auth)

12577

SHIELDING FROM THE γ -RAYS EMERGING FROM THE BASE OF A CYLINDRICAL SOURCE. D. P. Osanov. *Atomnaya Energ.* 6, 333-8(1959) Mar. (In Russian)

Data are given on calculations for shielding against γ radiation from a cylindrical source base. The calculations are carried out with the assumptions that the active material is uniformly distributed along the volume of the source and each elementary volume emits γ quanta of similar energies. (R.V.J.)

12578

THE MEASUREMENT OF RADIATION SAFE ISOTOPE CONTAINERS. Rolf Plesch (Siemens and Halske AG, Karlsruhe, Ger.). *Atompraxis* 5, 49-53(1959) Feb. (In German)

A previously described method of calculating radiation shield thicknesses in an extended gamma-radiation field (*Atompraxis* 4, 402(1958)) is modified in this study so that it can also be used for calculating the wall thicknesses of isotope containers. For this purpose a container number K_0 is defined, with which the calculation is possible by means of generally valid diagrams. By taking into consideration the predetermined distance of the source from the inner side of the wall, it is possible, in cases where this distance is important, to reduce the thickness of the shield. The necessary correction factors are given in diagrams. In conclusion, the case of complex gamma-emitters is discussed. (auth)

12579

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 23. EXPERIENCE IN RADIOLOGICAL PROTECTION. Geneva, United Nations, 1958. 461p. \$14.50.

New developments in radiation protection and recovery are reviewed. Topics discussed include developments in experimental therapy, methods for the assessment of biological contamination, radiation in the natural environment, experience in radiological protection and the control of radiation hazards, the evaluation of radiation hazards, the development of instruments for the detection of contamination, and the treatment of internal contamination. (C.H.)

INSTRUMENTS**12580 AE-5**

Aktiebolaget Atomenergi, Stockholm.
ABSOLUTE MEASUREMENTS WITH A 4 π -COUNTER. Kerstin Martinsson. Mar. 1958. Revised June 1958. 25p.

Measurements on standardized β emitters were made in a 4- π proportional flow counter. The counter efficiency was found to be near 100%. Absorption curves were determined with plastic foils and aluminium. A comparison is made between the self-absorption arising in different methods of source preparation which include

precipitates and the use of wetting agents. The most reliable results were obtained with sources on aluminium foils, where the foil absorption was calculated from the absorption curves and the self-absorption is supposed to be negligible for isotopes with end point energy above 0.5 Mev. The β -emitters studied have energies ranging from 1.71 Mev (P^{32}) to 0.167 Mev (S^{35}). (auth)

12581 AECU-3884

Los Alamos Scientific Lab., N. Mex.
AN X-RAY DIFFRACTION CAMERA FOR USE AT LIQUID HELIUM TEMPERATURE. A. F. Schuch. [1955]. 8p. Contract [W-7405-eng-36]. \$1.80(ph), \$1.80(mf) OTS.

A camera and cryostat are described for obtaining Hull-Debye-Scherrer diffraction patterns of samples at the temperature of liquid helium. (auth)

12582 AERE-HP/M-53

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A DEVICE FOR TESTING FILM-BADGE HOLDERS FOR ALPHA AND BETA-GAMMA CONTAMINATION. L. W. D. Pittendrigh. July 1953. Changed from OFFICIAL USE ONLY Apr. 30, 1959. 3p.

Routine issue and collection of health film badges in holders has revealed that the holders can become contaminated. The device described enables rapid testing of the holders for alpha and beta-gamma contamination to be carried out. (auth)

12583 BNL-2686

Brookhaven National Lab., Upton, N. Y.
HIGH ENERGY GAMMA SPECTROSCOPY. C. E. Swartz. [1956]. 25p. \$4.80(ph), \$2.70(mf) OTS.

For presentation at the Fifth Scintillation Counter Symposium, Washington, D. C., February 28-29, 1956.

Gamma spectroscopy in the Bev region is discussed generally, and developments in total absorption methods and equipment are reviewed. The principle of the total absorption method is outlined, and several experimental arrangements utilizing this technique are described. (A.C.)

12584 CERN-59-10

European Organization for Nuclear Research, Geneva.
CONFERENCE INTERNATIONALE SUR LES INSTRUMENTS POUR L'EVALUATION DES PHOTOGRAPHIES, REUNIE AU CERN A GENEVE LE 23 FÉVRIER 1959: RÉSUMÉ. (International Conference on Instruments for the Evaluation of Photographs, held by CERN at Geneva, February 23, 1959: Résumé.) Mar. 11, 1959. 17p.

A summary is presented of the topics discussed at a meeting to consider the possibility of standardized specifications and group orders for instruments used in the scanning and evaluation of nuclear emulsions. A survey was made of the programs of Great Britain, Italy, France, and Germany. The instruments needed were classified and a committee was formed to determine the needs, study the specifications, and contact the proper industries. (J.S.R.)

12585 GPT-16

Atomic Energy of Canada Ltd., Chalk River, Ont.
A HALOGEN COUNTER, TYPE HBM, FOR USE IN A GASEOUS-FISSION-PRODUCT MONITOR. I. L. Fowler and L. A. K. Watt. July 22, 1954. 21p. (AECL-792). \$0.50(AECL).

A halogen-quenched end-window beta counter of unusual design has been developed to meet the needs of a gaseous-fission-product monitor for the NRU reactor.

Tests indicate that it should give a satisfactory performance over a long operational life. Designs for the associated gas-cell and monitor-head have also been made. (auth)

12586 HW-51381

General Electric Co. Hanford Atomic Products

Operation, Richland, Wash.

FEASIBILITY OF A SOLAR FURNACE FOR EX-REACTOR THERMAL STUDIES. Herbert W. Newkirk, Jr. and M. Keith Millhollen. July 15, 1957. 9p. Contract [W-31-109-eng-52]. \$1.80(ph), \$1.80(mf) OTS.

A solar furnace was designed for developing the required high thermal fluxes necessary for ex-reactor experiments on ceramic fuel materials such as uranium dioxide. The solar furnace provides a source of heat not obtained by conventional furnaces. The design of the furnace indicates that the properties of uranium dioxide can be easily and accurately determined, e.g., melting characteristics, reactivity with water, cladding material, thermal conductivity, and emissivity. (J.E.D.)

12587 HW-59614

General Electric Co. Hanford Atomic Products

Operation, Richland, Wash.

BROADBAND ELECTROMAGNETIC TESTING METHODS. PART I. ANALYTICAL BASIS. H. L. Libby. Jan. 31, 1959. 22p. Contract W-31-109-Eng-52. \$4.80(ph), \$2.70(mf) OTS.

A mathematical basis for use of broadband methods is presented based upon the analysis of an electrical network which is approximately equivalent to a basic electromagnetic test. It is shown that the input impedance of the equivalent circuit over a wide range of frequencies is unique for any given set of conditions within the network representing test specimen conductivity and layer thicknesses. The interpretation of the input impedance function analytically in terms of the variables of the network which affect it is found to be very difficult, if indeed possible. The response of the equivalent network is calculated for a step function input, for an impulse function input, and as a function of frequency. Measurements of the network made with a phasoroscope (vectorscope) indicate that the network is a reasonable approximation to the electromagnetic test. Tests made applying an impulse drive function to the equivalent circuit confirm the general form of the calculated response function. The groundwork has been established for the next phase of the investigation which will be a combined experimental and analytical approach with the objective of interpreting changes in the response function in terms of specific changes in test specimen (equivalent circuit) conditions. (auth)

12588 IGD-R-1

United Kingdom Atomic Energy Authority. Industrial Group. Dounreay Experimental Reactor Establishment, Caithness, Scotland.

COUNTING PRACTICE: A GUIDE TO BASIC TECHNIQUES. W. R. Diggle and A. E. Shaw. 1958. 48p. \$0.84(BIS).

A concise account is given of the nature and sources of radioactivity and the theory of the interaction of radiation with matter. The various types of radiation detectors and the principles of their operation are described in some detail, together with a discussion of some more specialized techniques. A section on counting-errors and corrections is followed by a brief survey of commercial equipment available. (auth)

12589 IGR-R/CA-163

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

THE CONVERSION OF AN M.S.3 FOR THE ISOTOPIC ANALYSIS OF LITHIUM. J. Bishop, R. P. Briercliffe, and P. G. Bentley. Feb. 8, 1956. 13p.

Modifications to a standard Metropolitan-Vickers Type M.S.3 Mass Spectrometer (originally designed for gas analysis) are described. A suitable method for the isotopic analysis of lithium is given, and some effects which may alter the measured isotope ratio are described. The precision of a single measurement of isotope ratio is $\pm 0.7\%$ at 95% confidence level. Due to mass discriminations which may occur, the absolute accuracy of isotope ratio measurements is quoted $\pm 2.0\%$. Assuming that the mass discriminations are such that $R = KR'$, where R is the true isotope ratio, R' is the measured isotope ratio and K is a constant independent of R ; the separation factor, Q , can be measured to a known standard of accuracy which is $\pm 1.0\%$ of Q at 95% confidence level for a single measurement on each sample. A complete single analysis using the M.S.3 requires 3 machine hours and 4 man hours. (auth)

12590 LA-2280

Los Alamos Scientific Lab., N. Mex.

DESIGN AND OPERATION OF A NEW PHOTOELECTRIC COMPARATOR FOR WAVELENGTH AND INTENSITY MEASUREMENTS OF SPECTRA. David W. Steinhaus. July 1958. 29p. Contract W-7405-eng-36. \$1.00(OTS).

A photoelectric comparator that can be used for making wavelength measurements, intensity measurements, and observations of the shapes of spectral lines is described. The instrument is similar to one reported by Tomkins and Fred with improvements in the optics. (auth)

12591 RAE-TN-MET-293

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

A PHOTO-ELECTRIC LOAD MONITOR FOR RAPID TENSILE TESTING. B. F. Billing. July 1958. 9p.

A photo-transistor fitted to the load indicating pointer of a 5000 lb max. capacity mechanical tensile testing machine was used to monitor uniform increments of load, operating a camera which recorded, at these increments, the strain as indicated by an optical extensometer. Reliable operation was obtained at speeds up to five load/extension readings per second. (auth)

12592 REIC-6(Add.)

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

A SURVEY OF CURRENT RESEARCH AND DEVELOPMENTS IN THE FIELD OF DOSIMETRY (FIRST ADDENDUM). Mary J. Oestmann and J. F. Kircher. Mar. 31, 1959. 20p. Project No. 2133. Contract AF33(616)-5171. (AD-210766).

This is the first addendum to the REIC Report No. 6 "A Survey of Current Research and Developments in the Field of Dosimetry." Very few new dosimeter concepts have been reported during the past year. Advances made during 1958 consist primarily of refinements of the previously established dosimeter systems. Investigations have involved reaction mechanisms and the determination of more accurate G-values. An appropriate choice of materials has helped to extend the useful range of some dosimeters. Standard foils and methods of measurement of these foils are being developed for

neutron dosimetry. Further details on any one system may be found from the extensive bibliography provided. (auth)

12593 SCTM-107-59(12)

Sandia Corp., Albuquerque, N. Mex.
GALVANOMETER ISOLATION PIER. L. T. Wilson and L. H. Bressan. Apr. 6, 1959. 12p. Contract [AT(29-1)-789]. \$3.30(ph), \$2.40(mf) OTS.

An economical shock and vibration isolation system was designed to isolate d-c reflecting-type galvanometers used in the Sandia Corporation Primary Standards Laboratory. Tests proved that the system is adequate. It is readily adaptable to other applications. (auth)

12594 UCRL-8569

California, Univ., Berkeley. Lawrence Radiation Lab.
MILLIMICROSECOND DISCRIMINATOR. David F. Swift and Victor Perez-Mendez. Dec. 23, 1958. 12p. Contract W-7405-eng-48. \$0.50(OTS).

A discriminator circuit for use with millimicrosecond counting equipment is described. The main characteristics of this unit are its good response to pulses as short as 3 millimicroseconds and the fast recovery time which is less than 0.15 microsec. (auth)

12595 UR-525

Rochester, N. Y. Univ. Atomic Energy Project.
DESIGN STUDIES DIRECTED TOWARD A SELF-NULLING BALANCED-CHAMBER ION-CURRENT INSTRUMENT. Lowell L. Anderson. Apr. 1, 1958. 197p. Contract W-7401-eng-49. \$3.50(OTS).

A self-nulling circuit incorporating balanced ionization chambers constitutes a measuring system in which the output is largely independent of electrical circuit parameters. Both experimental and theoretical analyses indicate, however, that the feasibility of a wide-range survey instrument of this type is severely limited when a conventional electrometer d-c amplifier is employed. It is shown that stability at high dose rates is incompatible with an acceptably rapid low-dose-rate time response. An auxiliary circuit is described which resolves the difficulty by providing transient negative feedback to the floating-grid electrometer input. The feedback path involves current, rather than voltage, feedback and is completed through the measuring ionization chamber by virtue of the non-zero slope of the chamber voltage plateau. An experimental model of the instrument exhibited stability throughout a range of nearly five decades. (auth)

12596 USNRDL-TR-302

Naval Radiological Defense Lab., San Francisco.
A SIMPLE CALIBRATION AND CHECKING FACILITY FOR FAST AND SLOW NEUTRON DETECTORS. A. H. Redmond. Jan. 28, 1959. 19p.

A simple facility is described for checking the sensitivity of dose rate instruments for fast neutron detection, and for calibration of thermal neutron detectors. About 7 million plutonium-beryllium neutrons per second give a tolerance flux density of slow neutrons from the walls of a cavity in paraffin or water. Construction drawings of the cavity are given, and for the dimensions specified the constant is given for converting any plutonium-beryllium flux of neutrons to combined thermal and epithermal flux densities, so that instruments can be calibrated in standard flux densities. The fast neutron dose rate detectors use the same source, which has been shown to be equivalent to a polonium-beryllium source of the same strength, for a sensitivity check. A modified procedure using the source in the cavity is

shown to give a somewhat lower flux of fast neutrons on the detector, but a rapid check can be made without setting up the source in air. Measurements around the cavity with an additional insert of three inch-thick paraffin surrounding the source-holding tube show that the dose rate from fast neutrons around the cavity used for source storage is less than that around the original shipping container at comparable distances. The slow neutron flux density around the cavity during storage is negligible. (auth)

12597 CEA-tr-A-524

MESURE CONTENUE DE LA TENUEUR DE L'AIR EN AÉROSOLS RADIOACTIFS. (Continuous Measurement of the Concentration of Radioactive Aerosols in the Air.) W. Buchner. Translated into French from *Atompraxis* 3, 382-8(1957). 23p.

An apparatus for the continuous measurement of the radioactive aerosol contamination of the air is described. The aerosols are collected on a filter band which passes by a scintillation counter which measures the total activity of the dust. The speed of the filter band can be varied so that there is a delay of $\frac{1}{2}$ to 3 days before the filter band passes the second counter. This delay gives a measurement of the activity of the short-lived aerosols in the atmosphere. The counters used are scintillation counters. The standardization of the apparatus is described. The sensitivity of the apparatus is determined. (J.S.R.)

12598 CEA-tr-A-534

SPECTROMÈTRE À SCINTILLATIONS POUR RAYONNEMENT GAMMA. II. (Scintillation Spectrometer for Gamma Radiation II.) K. Jordan. Translated into French from *Arch. Tech. Messen*, Lfg. 262, 241-4 (1957). 17p.

The photomultiplier used in scintillation spectrometers for the detection of gamma radiation is reviewed. The principle and operation of photomultipliers and the possible causes of error are considered. The causes of the parasitic current are discussed. (J.S.R.)

12599 CEA-tr-A-538

SPECTROMÈTRE DE MASSE H.F. ET SON UTILISATION DANS LA TECHNIQUE DU VIDE. I. (H.F. Mass Spectrometer and Its Utilization in Vacuum Techniques. I.) P. F. Varadi, L. G. Sebestyen, and E. Rieger. Translated into French from *Vakuum-Tech.* 7, 13-16(1958). 13p.

A portable high-frequency mass spectrometer is described. A simple spectrometer with low resolution power was designed for the investigation of leaks. It operates in the range from 10^{-3} to 10^{-7} Torr and can detect leaks up to 2.8×10^{-8} Torr/sec. The installation can be used also as an ionization manometer for the measurement of the total pressure. (tr-auth)

12600

THE DEPENDENCE ON pH FOR THE FORMATION OF LATENT IMAGES IN NUCLEAR EMULSIONS. [PART] I. Marieta Nicolae. *Acad. rep. populare Romîne, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz.* 9, 39-51(1958). (In Rumanian)

An investigation was made to show the effect of pH on the sensitivity of nuclear emulsions and the extent to which the pH effect could be reversed. The pH limits in which reversible and irreversible variations of the sensitivity are caused were established. The use of an impregnating solution with pH less than 3 causes a strong decrease of the sensitivity (50 to 100%)

which is reversible to a large extent. For $\text{pH} > 8$, a reversible increase of the sensitivity was found at the same time as an irreversible decrease of the sensitivity. The reversible effect was attributed to the effect of the double layer of space charges formed on the crystal interface on the formation of the latent image. The irreversible effect was produced by ion impurities diffusing in the crystal and the effect of these ions on the centers of sensitivity. (tr-auth)

12601

UTILIZATION OF SCINTILLATION COUNTERS FOR THE DETECTION OF FAST NEUTRONS. M. Nachman, L. Schlichter, and H. Tojia. Acad. rep. populare Romîne, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz. **9**, 497-504(1958). (In Rumanian)

The possibility of using scintillation counters of the Chang and Rosenblum type for the detection of fast neutrons by the recoil nuclei method was studied. Counters filled with air, nitrogen, or hydrogen at atmospheric pressure were constructed. A graphic method was developed to determine the resistance of optimum charge of the counter. The counters have good plateaus and a negligible background and are insensitive to gamma rays. The nitrogen-filled counters are sensitive to thermal neutrons because of the $\text{N}^{14}(\text{n},\text{p})\text{C}^{14}$ reaction. (tr-auth)

12602

SEMI-AUTOMATIC INSTALLATION FOR THE SEPARATION AND PURIFICATION OF RADON. Al. Sanielevici. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **6**, 369-72(1955) Apr.-June. (In Rumanian)

12603

AUTOMATIC ADIABATIC MICROCALORIMETER FOR THE MEASUREMENT OF RADIOACTIVITY. A. Hîlf and Al. Sanielevici. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **6**, 373-6(1955) Apr.-June. (In Rumanian)

12604

EFFECTS OF Hg VAPOR ON NUCLEAR EMULSIONS. Marieta Nicolae. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **7**, 479-84(1956) July-Sept. (In Rumanian)

12605

SELF-CONTAINED PREAMPLIFIER FOR PROPORTIONAL COUNTERS. George E. Bradley (Western Michigan Univ., Kalamazoo). Am. J. Phys. **27**, 365 (1959) May.

A self-contained preamplifier for a proportional counter is described. The preamplifier is used in conjunction with a scaler. The circuit is transistorized and may be contained in a small chassis attached to the counter. Only one cable to the scaler is required. (A.C.)

12606

A SCINTILLATING GLASS FOR DETECTING SLOW NEUTRONS. V. K. Voitovetskii, N. S. Tolmacheva, and M. N. Arsaev. Atomnaya Energ. **6**, 321-6(1959) Mar. (In Russian)

Descriptions are given of the preparation and properties of scintillation glass. The glass, composed of $\text{Li}_2\text{O} \cdot 2\text{SiO}_2(\text{Ce})$, can be used for detecting slow neutrons. Efficiency in relation to $\text{NaI}(\text{Tl})$ at electron excitation is 1.4%. The scintillation emission ratio for electrons and α particles is 3.8 to 4. The scintillation time constant is $\sim 0.15 \mu\text{sec}$. The efficiency of 1-cm thick, lithium-containing (with 90.5% concentration of

Li^6) glass for thermal neutrons was 82%. For 10-ev neutrons the efficiency of the 0.5-cm thick glass is 40%. (tr-auth)

12607

PREPARATION OF PLASTIC SCINTILLATORS. E. E. Baroni and V. M. Shoniya. Atomnaya Energ. **6**, 330-2(1959) Mar. (In Russian)

The apparatus and the direct method for preparing plastic scintillators by thermal polymerization in enclosed metallic containers are described. (R.V.J.)

12608

THE USE OF STANDARD β -COUNTERS FOR γ -RAY DOSIMETRY. B. P. Bulatov. Atomnaya Energ. **6**, 332-3(1959) Mar. (In Russian)

Dosimetric properties of the typical laboratory β counters STS-5 (10 mm in diameter, 65 mm operating length, and 48.5 mg/cm^2 wall thickness), STS-6 (18 mm in diameter, 130 mm operating length, and steel wall thickness 48.5 mg/cm^2), and MST-17 front window counter (20 mm in diameter with 5 mg/cm^2 mica window thickness) were tested. The sensitivity dependence of the STS-5, STS-6, and MST-17 counters on the radiation energy E_γ was plotted, and the ϵ values tabulated. (R.V.J.)

12609

SPECTROPHOTOMETRIC MEASUREMENTS ON NATURAL AND IRRADIATED KUNZITE. Slobodan Ristić and Stanislava Lipovac. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 77-89(1959).

Spectrophotometric curves for different varieties of kunzite crystals were measured in the spectral region 2000 to 10,000 Å for the natural, the x-irradiated, and discolored forms. An important relationship between the doses received and the total areas under the corresponding spectrophotometric curves was found in spite of the existence of disturbing effects ("time-effect" and "temperature effect") which need close control and further investigation. The use of kunzite crystals for x-ray dosimetric purposes in the range from 100 to 100,000 seems to be quite possible. (auth)

12610

COINCIDENCE METHOD FOR THE DETERMINATION OF SPURIOUS COUNTS. Vladimir S. Ajdačić. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade) **9**, 219-21 (1959).

For a fast and accurate evaluation of spurious counts a numerical coincidence method was developed. This method makes use of an auxiliary counter operated in coincidence with the counter under investigation. From the number of noncoincident counts from the investigated counter the number of its spurious counts can be determined. (auth)

12611

EXPERIMENTAL STUDY OF A RAPID COINCIDENCE CIRCUIT AT LOW ENERGIES. Serge Gorodetzky, Robert Manquenouille, Raymond Richert, and Jacques Lefort. Compt. rend. **248**, 2202-4(1959) Apr. 13. (In French)

The utilization of a rapid coincidence circuit with high resolution for the measurement of the average life of excited nuclear levels necessitates the knowledge of the sensitivity of the circuit. The different coincidence curves obtained with two counters were studied. The values found follow a linear law in logarithmic coordinates and show that the coincidence circuit is sensitive to the signal produced by the first photoelectron created

at the photocathode of the photomultiplier. The corrections to be applied to coincidence measurements are discussed and applied to measurements of the 84-kev level of Yb^{170} . The result $T_{1/2} = 16 \pm 2 \times 10^{-10}$ sec is in agreement with previous values. (J.S.R.)

12612

THE INSTALLATION FOR MEASURING AND STABILIZING MAGNETIC FIELDS IN SPECTROMETERS.

Yu. S. Egorov, D. M. Seliverstov, G. D. Latyshev, and A. I. Zhernovoi (Obraztsov Leningrad Inst. of Transportation). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 244-50 (1959) Feb. (In Russian)

Descriptions are given of a universal spectrometer magnetic field meter and stabilizer operating on the principle of nuclear magnetic resonance. The installation is capable of measuring magnetic fields in the range 3 to 2500 gauss; stabilization is achieved at 10 to 2500 gauss. The considerable expansion of lower register range was accomplished by the preliminary magnetization of water which is used in the transducer. The order of measuring precision for magnetic fields over 100 gauss is $< 10^{-6}$. (R.V.J.)

12613

THE NUCLEAR RESONANCE FREQUENCY RECORDER.

Yu. S. Egorov, D. M. Seliverstov, and G. D. Latyshev (Obraztsov Leningrad Inst. of Transportation). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 251-4 (1959) Feb. (In Russian)

A recorder was designed for measuring nuclear resonance frequencies by comparing the measured frequencies with quartz frequencies. (R.V.J.)

12614

ON PROBLEMS OF LINEARITY IN SCINTILLATION SPECTROMETRY. I. SCINTILLATION REACTION OF INORGANIC CRYSTALS TO γ EXCITATION. Yu. A. Nimilov, I. I. Lomonosov, A. N. Pisarevskii, L. D. Soshin, and E. D. Teterin (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 257-62 (1959) Feb. (In Russian)

Radioactive isotopes with well known γ transition energies were used as sources in linearity measurements on inorganic crystals with an order of precision up to 1%. Results are tabulated. The natural resolving and conversion efficiency of NaI(Tl) and distortions of the total energy lines by the NaI(Tl) crystals are discussed. (R.V.J.)

12615

AMPLIFICATION OF PHOTOMULTIPLIERS DURING INTERMITTENT MEASUREMENTS. A. N. Pisarevskii and E. D. Teterin. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 263-4 (1959) Feb. (In Russian)

Various types of photomultipliers were studied by improved methods. The results indicated (for all types of intermittent multipliers) a certain disparity between the values of static and pulse amplifications which can be expressed by an after-effect parameter n . (R.V.J.)

12616

CALIBRATION AND USE OF A SYSTEM OF FILM BADGES FOR PERSONAL DOSIMETRY FOR GAMMA RADIATION. P. Amadesi, N. Grimellini, G. Guenzi, and O. Rimondi (Università, Bologna). *Minerva nucleare* **3**, 44-57 (1959) Feb. (In Italian)

A method of calibration of a film-badge system for gamma radiations from radioisotopes is described. The criteria for the choice of emulsion and the system adopted for correcting the response from the energy

dependence are shown. The energy dependence is corrected by a metallic filter, made by 1 mm of tin and 0.5 mm of lead superimposed. A systematic study of errors due to fading, dark room processes, and energy dependence is made. The error due to energy dependence from 80 to 200 kev (critical zone) was experimentally determined. Comparing the film-badge system with Victoreen pocket chambers it was seen that the analyzed film-badge does not present a systematic error greater than the chamber's error. The accuracy of the film-badge system is given by the formula: $E = (6\% D + 4)$ milliroentgen, where D is the measured dose in "mr," neglecting, of course, the errors for the energy dependence. This film-badge system is used in personal dosimetry for workers in six nuclear laboratories in Italy. (auth)

12617

TRANSMISSION IONIZATION CHAMBER FOR HIGH ENERGY ELECTRONS. B. Bellion and G. Magistrali (Università, Turin). *Minerva nucleare* **3**, 60-3 (1959) Feb. (In Italian)

A transmission ionization chamber for high-energy electrons, adapted for use with the electron beam produced by a 31-Mev betatron, is described. (auth)

12618

HIGHLY DIRECTIONAL DETECTOR FOR COSMIC RAY PARTICLES. G. W. Hutchinson (Univ. of Birmingham, Eng.). *Nuovo cimento* (10) **11**, 377-81 (1959) Feb. 1.

A relatively simple Cherenkov detector is described which will respond to relativistic charged particles only when their directions lie within a well-defined cone. The limits of the cone are determined by the critical reflection of Cherenkov light from parallel faces of the radiator. The semiangle of the cone may be chosen at will by varying the refractive indices used. It is suggested that the detector might be useful for attempts to detect a directional flux of uncharged primary particles at high altitudes. (auth)

12619

COSMIC-RAY INSTRUMENTATION IN THE FIRST U. S. EARTH SATELLITE. George H. Ludwig (State Univ. of Iowa, Iowa City). *Rev. Sci. Instr.* **30**, 223-9 (1959) Apr.

The first U. S. satellite, 1958 Alpha (Explorer I), carried instrumentation to measure cosmic-ray intensity, micrometeorite impacts, and temperatures within the satellite. The instrumentation was designed with emphasis on conservation of electrical power, on stable and reliable operation, on operation over a wide range of temperatures, and on compactness and mechanical ruggedness. The cosmic-ray instrumentation in 1958 Alpha operated according to expectations, providing several hundred recordings of data received during transits over ground stations. These data led to the discovery of a belt of high-intensity radiation around the earth. (auth)

12620

AUTOMATIC CLOUD CHAMBER FOR GAS DISCHARGE STUDIES. K. R. Allen and K. Phillips (Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester, Eng.). *Rev. Sci. Instr.* **30**, 230-4 (1959) Apr.

A large volume expansion chamber (25-cm diameter, 25 cm deep) was constructed to investigate prebreakdown ionization processes in gaseous discharge. A homogeneous field electrode system was mounted within the chamber and provision was made for irradiation of the cathode. The chamber could be operated automati-

cally at pressures from 40 to 68 cm Hg with a recycling time of about 5 min. Associated circuits for the production of millimicrosecond pulses up to 70 kvp are described. Some preliminary photographs of point-plane breakdown and of electron avalanches in a homogeneous field electrode system are shown. (auth)

12621

ION OPTICS FOR THE V-TYPE SURFACE IONIZATION FILAMENT USED IN MASS SPECTROMETRY. Leonard A. Dietz (Knolls Atomic Power Lab., Schenectady, N. Y.). Rev. Sci. Instr. **30**, 235-41(1959) Apr.

A field-plotting and ray-tracing technique based on electron-optical methods is developed for first-order ion optics of slit lenses and is applied to a Nier-type thick lens. A resistance paper analog gives the distribution of electrostatic potential. Maxwellian velocities of ions emitted from the filament and lens thickness affect ion trajectories, which are calculated to a few per cent accuracy by a simple approximation technique. Paraxial ray paths are shown and the ion-focusing action of the single filament is described. Optimum detectability, 100 counts of the smallest isotope, is 5×10^{-15} g for uranium and 2×10^{-15} g for plutonium. Ionization at moderate temperatures improves transmission and avoids background impurities which appear at temperatures above 2000°C. Independent electrostatic focusing in the z direction improves transmission through the analyzer. (auth)

12622

LINING-UP NUCLEAR EMULSION STACKS. S. Taylor, G. Harris, J. Orear, P. Baumel, and J. Lee (Columbia Univ., New York). Rev. Sci. Instr. **30**, 244-5(1959) Apr.

A method was devised for introducing reference marks in stacks of nuclear emulsion pellicles by the use of single-strand threads. The reference marks were then used for accurate lining-up of the stack after development. Details of the thread insertion and lining-up processes are described. (auth)

12623

ION FOCUSING PROPERTIES OF A QUADRUPOLE LENS PAIR. H. A. Enge (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. **30**, 248-51(1959) Apr.

The focusing properties of a quadrupole lens pair were studied, and the results of thick-lens calculations are presented in the form of graphs showing the field strength parameters and magnifications as functions of object and image distances. (auth)

12624

STRONG FOCUSING ION SOURCE FOR MASS SPECTROMETERS. Clayton F. Glese (Univ. of Chicago). Rev. Sci. Instr. **30**, 260-1(1959) Apr.

An ion source was developed, using strong-focus principles, with a view toward obtaining high transmission through sector-shaped magnetic fields. The lens described, starting with an ion beam 0.375 in. square, produces a line focus 0.60 in. long and 0.025 in. wide, with a half-angle of divergence beyond the crossover of 0.034 rad. (auth)

12625

WIDE rf LEVEL rf UNIT FOR AN NMR SPECTROMETER. K. N. Kapur and J. W. McGrath (Kent State Univ., Ohio). Rev. Sci. Instr. **30**, 272-4(1959) Apr.

An improved r-f unit for a nuclear magnetic resonance spectrometer is described. It uses a crystal oscillator for frequency stability and positive feedback from a cathode follower to increase the effective Q of

the sample r-f coil. This unit provides an r-f level range of 20 μ v to 60 mv with little limitation on extending the range. This allows saturation studies. The circuit is well suited to direct relaxation time measurements. (auth)

12626

PRECISION INTEGRATOR FOR ION BEAMS. Frank J. Lynch and Alexander Langsdorf, Jr. (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. **30**, 276-9(1959) Apr.

The integrator consists of a circuit which operates relays to turn off data-storage devices, timers, etc., when the charge conducted by an ion beam reaches a specified quantity. A vibrating-reed electrometer (without feedback) senses when the potential drop across a capacitor into which the beam current flows becomes equal to the potential of several standard cells in series. Errors in sensing the potential are less than 0.001%, and the over-all time delay of the relay operation is about 15 msec. The major sources of error are associated with soakage and changes in capacitance with temperature, less than 0.05% and about -0.01% per °C, respectively. It should be feasible to attain a considerable reduction in all the errors of integration caused by these known sources of error. (auth)

12627

PERFORMANCE OF A PISTON-EXPANDED BUBBLE CHAMBER. H. Courant, J. E. Jensen, R. I. Louttit, and J. R. Sanford (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. **30**, 280-1(1959) Apr.

With liquid hydrogen as the track sensitive medium, electron tracks were observed from 26.1 to 28.9°K. Using liquid deuterium, the range was 30.5 to 32.6°K. The upper limits in both cases were imposed by the apparatus. Data on expansion pressures, sensitive times, and refrigerant consumption are presented. (auth)

12628

TEN-Mc PULSE-AMPLITUDE DISCRIMINATOR. Jacques Mey (Univ. of California, Berkeley). Rev. Sci. Instr. **30**, 282-4(1959) Apr.

A pulse-height discriminator was developed which is capable of operating at repetition rates up to 10 Mc. It accepts positive input pulses with a threshold adjustable from 1 to 11 v. The output signal is of constant shape and amplitude. The circuit is described and test results are given. (auth)

12629

HIGH-TEMPERATURE LABORATORY VACUUM FURNACE. E. V. Kornelsen and J. O. Weeks (National Research Council, Ottawa). Rev. Sci. Instr. **30**, 290-1(1959) Apr.

A small resistance-heated vacuum furnace for laboratory use is described. A temperature of 1600°C can be achieved with an expenditure of 2 kw of heating power. The heating element is fabricated from a molybdenum sheet and is perforated to increase its resistance. An optical pyrometer was used for temperature measurement, but provision is made for installing a thermocouple. (A.C.)

12630

BELLOWS SEAL HAND TOOL. Albert Pearl (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. **30**, 294-5(1959) Apr.

Bellows seal hand tools are described which permit reciprocating and angular motion or any combination of

the two to be transmitted through sealed barriers such as boxes which contain high levels of radioactive alpha emitters. They may also be used inside vacuum chambers and in vessels containing highly corrosive chemicals. (A.C.)

12631

IMPROVED LOW REPETITION RATE MILLIMICRO-SECOND PULSE GENERATOR. C. A. Burrus (Bell Telephone Labs., Inc., Holmdel, N. J.). *Rev. Sci. Instr.* 30, 295-6 (1959) Apr.

A pulse generator is described which is capable of supplying very short pulses of relatively high current. A material increase in repetition rate for certain pulse-generating applications may be obtained with the Western Electric 226B mercury switch. (A.C.)

12632

A DOSIMETER FOR THE MEASUREMENT OF LOW DOSE RATES IN PROTRACTED X IRRADIATIONS. Albrecht Wensel and Irmgard Wensel-Wolf (Max-Planck-Institut für Biophysik, Frankfurt am Main). *Strahlentherapie* 108, 552-5 (1959) Apr. (In German)

For the determination of the time factor of marked protracted irradiation at a low dose rate, a dosimeter is required which is reliable over a long period of time. The design and circuit of a dosimeter for this purpose was described. Over a discriminating circuit impulses of current are directed to a meter. After standardization the dose rate can be determined according to the number of impulses. (auth)

12633

AN IONIZATION CHAMBER FOR THE MEASUREMENT OF HIGH DOSE RATES. Kurt Heuss (Max-Planck-Institut für Biophysik, Frankfurt am Main). *Strahlentherapie* 108, 556-8 (1959) Apr. (In German)

A parallel plate condenser chamber is described which is suitable for high x radiation dose rates.

Factors influencing the degree of saturation such as plate distance, dose rate, and voltage are discussed. (auth)

12634

STRUCTURAL CHANGES IN ANODE SURFACE DURING ITS DISINTEGRATION. B. M. Bulygin (Ivanovsk Inst. of Chemistry and Tech.). *Zhur. Priklad Khim.* 32, 494-9 (1959) Mar. (In Russian)

The alterations taking place on the graphite anode surface during electrolysis were studied by a microphotographic method and by determining the micro weight of the anode at various points. The maxima of surface disintegration, the character of porosity changes, and structural changes in linseed oil impregnated and non-impregnated anodes were determined. (R.V.J.)

12635

THE DESIGN AND OPERATION OF A SHUNT REGULATED 25,000 JOULE INDUCTIVE ENERGY STORAGE SYSTEM. Preprint V-100. R. L. Gamblin (Princeton Univ., N. J.). New York, Engineers Joint Council, [1959]. 19p.

The natural voltage characteristic of a shunt-regulated inductive energy storage system is described. The development of a jitterless (less than 10^{-6} sec.) switching scheme is described. Problems of economics and coil loss due to high frequency components are considered. (auth)

12636

RADIO-ACTIVE MEASURING SYSTEM DENSITY

COMPENSATION. (to The Foxboro Co.). British Patent 809,018. Feb. 18, 1959.

A radiometric thickness gage is described in which compensation for ambient temperature or barometric pressure variations is made. The source is a chamber containing Kr^{86} , the pressure of which is adjusted by adding or removing Kr^{86} by means of a bellows and spring-loaded screw arrangement. The ionization chamber pressure may be adjusted similarly. (T.R.H.)

12637

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR DETECTING RADIOACTIVE PARTICLE EMISSION. Isaac Alan Mossop, Philip Benson Fay, and Gordon Packman (to United Kingdom Atomic Energy Authority). British Patent 809,416. Feb. 25, 1959.

A beta particle detector which scans a tape or wire passed through a pressurized area to be monitored is described. The tape or wire is passed through a hole in a tetraphenylbutadiene-in-polystyrene phosphor which is fitted in the end of a sleeve projecting into the pressurized area. The phosphor is optically connected to a photomultiplier tube in the sleeve by a methyl methacrylate guide. The photomultiplier tube may be removed and replaced in the sleeve without breaking the sealed pressurized area. (T.R.H.)

12638

RADIO-ACTIVE MEASURING DEVICE. (to the Foxboro Co.) British Patent 811,042. Mar. 25, 1959.

A radioactive thickness gage is described which responds linearly to changes in thickness of the body being measured. This is accomplished by interposing a rotatable disk with an exponential slot between one of the source-ionization chamber pairs of the device. (T.R.H.)

12639

RADIO-ACTIVE MEASURING SYSTEM. (to the Foxboro Co.) British Patent 812,591. Apr. 29, 1959.

Two radioactive thickness gage arrangements are offered which overcome the adverse effect of source-chamber spacing. In one a low-energy beta source (Ti^{204}) and a high-energy beta source (Sr^{90}) are arranged on a platform opposite two ionization chambers, one for each source. The ionization chamber outputs are bucked against each other so that a difference of output is indicated on a deviation meter. The meter is zeroed by screw arrangements on each source which allow adjustment of each source-chamber space independently. The source platform is also provided with a screw so that both source-chamber spaces can be adjusted at once. The other thickness gage arrangement is similar, the difference being that only one source (Cs^{137}) is provided and the ionization chambers are either beta or gamma sensitive. (T.R.H.)

12640

IMPROVEMENTS IN OR RELATING TO PRESSURE GAUGES. William Millar (to United Kingdom Atomic Energy Authority). British Patent 812,632. Apr. 29, 1959.

A pressure gage is described in which the speed of a pulse through the gas is measured. The pulse transmitter and receiver are toroidal transformers, the secondary of which is a single turn including the diaphragm. The pulse waveform is square so that transient response of the diaphragm is minimized. A block diagram of the instrument arrangement is given. (T.R.H.)

12641

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR COMPARING THE INTENSITIES OF RADIATION FROM TWO RADIOACTIVE SOURCES. Robert Gordor David (to E. K. Cole, Ltd.). British Patent 812,952. May 6, 1959.

An ionization chamber-source arrangement for a thickness gage is described which eliminates the need for sealing and equalization of temperatures. It consists of two chambers separated by a perforated insulator board. The collector of the chambers has a conductor connected to the walls, and a simplification of adequate screening is described. The collector is foraminous in nature and is partially transparent to β radiation. (T.R.H.)

12642

IMPROVEMENTS IN OR RELATING TO ELECTRIC DISCHARGE TUBES FOR DETECTING RADIATION. (to Philips Electrical Industries, Ltd.). British Patent 812,969. May 6, 1959.

A halogen-quenched electric discharge tube with laminated electrodes is described. The electrodes are parallel plates separated by cylindrical or annular insulators, thus enclosing the discharge spaces. Such an arrangement gives a satisfactory plateau on the voltage versus counts curve. (T.R.H.)

METALLURGY AND CERAMICS

12643 AEC-4281

Los Alamos Scientific Lab., N. Mex.
CORROSION CHARACTERISTICS OF URANIUM. AN ELECTRON DIFFRACTION STUDY. James T. Waber and Dawn D. Whyte. [1956?]. Decl. July 12, 1956. 17p. Contract [W-7405-eng-36]. \$3.30 (ph), \$2.40 (mf) OTS.

The initial product formed on relatively oxide-free uranium has been shown by electron diffraction to be the alpha or low temperature form of uranium hydride. Such an oxide-free surface has been prepared by polishing the metal within the electron diffraction unit while maintaining a vacuum of 10^{-7} mm Hg. Uranium dioxide lines appear later and grow in intensity. Electron diffraction studies are reported on vacuum annealed metal. (auth)

12644 AECU-3818

Harvey Aluminum, Torrance, Calif.
ZIRCONIUM: A REVIEW AND SUMMARY OF PUBLISHED DATA. H. Loevenstein and H. L. Gilbert. Oct. 1958. 229p. For Savannah River Lab. Contract AT(07-2)-1. (DPWR-252). \$3.50(OTS).

A review and summary of published data on zirconium covering the chemical, physical, and mechanical properties, corrosion resistance, structure, fabrication, and the structure and properties of the alloys are reported. (J.E.D.)

12645 AECU-4065

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
GRAIN-BOUNDARY ENERGIES IN GOLD-COPPER ALLOYS. John E. Hilliard, Morris Cohen, and B. L. Averbach. [1958?]. 21p. (NYO-7057). \$4.80(ph), \$2.70(mf) OTS.

The ratio of grain-boundary to surface energy was determined as a function of composition in the gold-copper system. From interferometric measurements of

the boundary groove angles in specimens thermally etched at 850°C, the following average grain-boundary to surface-energy ratios were obtained: 0.25, 0.28, 0.34, 0.42, 0.37, and 0.36 at 0, 20, 40, 60, 80, and 100 at. % copper, respectively. Existing data for the surface energies yield 370, 320, 310, 390, 430, and 590 erg cm⁻², respectively, for the absolute grain-boundary energies. A calculation is included of the boundary adsorption corresponding to this energy variation, and an estimate is made of the minimum number of atoms required at the grain boundary to accommodate the calculated adsorption. (auth)

12646 AECU-4071

American-Standard. Atomic Energy Div., Mountain View, Calif.

MASS TRANSFER BY HIGH TEMPERATURE LIQUID SODIUM. Interim Progress Report No. 1. W. R. Holman. Feb. 3, 1958. 22p. Project D-14. \$4.80(ph), \$2.70(mf) OTS.

The design and development of equipment for obtaining mass transfer data in liquid sodium systems are reported. Preliminary data are given. (L.T.W.)

12647 AECU-4072

American-Standard. Atomic Energy Div., Mountain View, Calif.

MASS TRANSFER BY HIGH TEMPERATURE LIQUID SODIUM. Interim Progress Report No. 2. W. R. Holman. Oct. 15, 1958. 37p. Project D-14. \$6.30(ph), \$3.00(mf) OTS.

Experiments were carried out in thermal convection loops in which sodium was induced by thermal convection to flow past a number of accurately weighed corrosion specimens located at close intervals throughout the entire temperature range existing within the loop. The specimens were accurately weighed prior to and following the test, and the weight changes were used as a measure of local mass transfer. Operating conditions, dimensions, materials, and temperature distributions are tabulated. (For preceding period see AECU-4071.) (J.E.D.)

12648 AECU-4090

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

THE COBALT TRANSFORMATION. C. R. Houska, B. L. Averbach, and Morris Cohen. [Jan. 1957]. 21p. (NYO-7084). \$4.80(ph), \$2.70(mf) OTS.

The fcc \rightarrow hcp transformation in cobalt powder (equilibrium temperature = 417°C) was studied by x-ray methods and correlated with the density of stacking faults in both phases. Only the hcp phase is present in the cold-worked powder. The line broadening due to local strains and small particle sizes can be essentially removed by annealing at 300°C, leaving a residual broadening that permits a quantitative determination of the density of random growth and deformation faults. The latter are present in smaller numbers than the growth faults, and are more readily removed by recovery treatments. When the hcp phase is generated from the fcc phase by cooling through the allotropic transformation range, two types of faulted regions become evident: region 1 contains only deformation faults, and region 2 contains both deformation and growth faults. It is suggested that region 1 constitutes the first part of the hcp phase to form on cooling, while region 2 represents the latter part of the transformation. Approximately 25 to 30% of the parent fcc phase is retained at room temperature under these conditions. Faulting in the fcc phase can be detected with some assurance only

after the cooling transformation is underway, but the extent of such faulting is small compared to that in the hcp phase. The observed faulting in both phases is produced mainly by the allotropic transformation, and is not inherited from the parent phase. The faulting generated in the parent phase by the cooling transformation can be partly removed by holding at subcritical temperatures; it is thought that this relaxation process removes barriers to the fcc \rightarrow hcp transformation and is responsible for the small increments of the hcp phase which form isothermally in the same temperature range. An analysis of the broadening effects in the various diffraction lines suggests that the stacking faults do not terminate within the crystallites or subgrains, but extend to the boundaries. No evidence is found to signify any reversible extension or contraction of the faulting with changing temperature; that is, the faults observed are not in thermodynamic balance. (auth)

12649 AECU-4113

Case Inst. of Tech., Cleveland.

SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Final Report. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Apr. 1959. 170p. Contract AT(11-1)-258. \$25.80 (ph), \$7.80 (mf) OTS.

The three phenomena observed in the scaling of zirconium, i.e., the change in scaling rate, the color change of the oxide, and growth of the underlying metal, were investigated in the temperature range of 600 to 1300°C. Three grades of zirconium, varying in impurity content, were studied in atmospheres of air, oxygen, nitrogen, and oxygen-nitrogen mixtures. The three phenomena were found to occur in each grade of zirconium investigated and in all atmospheres except nitrogen. The times required for their occurrence are temperature dependent and are generally decreased by increasing impurity level of the metal. Zirconium initially scales at a relatively low rate which, in time, yields to a faster scaling rate (breakaway). Breakaway does not occur above 1000°C in air, however, no such limiting temperature was observed in oxygen. The initial oxide that forms on zirconium is black. This oxide transforms to white upon continued scaling. X-ray analyses revealed no difference between these scales, both are composed of tetragonal and monoclinic ZrO_2 with the monoclinic form predominating. This color transition of the oxide appears to be due to the absorption of oxygen and/or nitrogen. The growth suffered by zirconium upon scaling appears to be the result of a deformation process rather than a volume expansion. Growth was not observed above 1000°C in any atmosphere. This lack of high temperature growth in air appears to be due to a unique globular distribution of zirconium nitride in the oxide. The absence of high temperature growth in oxygen is associated with the manner in which cracks form in the scale resulting in the absence of oxide fingers. Experimental results suggest that all three phenomena are interdependent. A constant relation between the three cannot be stated as it appears to vary with purity of the zirconium and scaling temperature. The most general relationship appears to be as follows: scale color change leading to breakaway which, in turn, leads to growth. (auth)

12650 AERE-M/M-102

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CREEP OF ALPHA URANIUM DURING IRRADIATION OR

THERMAL CYCLING. A. H. Cottrell. Nov. 1955. 7p. (FRDC-P/146; TRDC-P/137).

A study was made of the effects of intergranular stresses, generated continuously during service by irradiation and thermal cycling, upon the creep properties of uranium. (J.E.D.)

12651 AERE-M/M-217

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HOT HARDNESS TESTS ON THORIUM AND SOME THORIUM-RICH ALLOYS. R. C. Burnett and J. R. Murray. Jan. 1959. 25p.

Hot hardness tests at temperatures up to 800°C were made on three samples of thorium and on several Th-Al, Th-U, and Th-Zr alloys in the as-cast, solution treated, and aged conditions. The results suggest that Th-Al alloys can be hardened by precipitation of Th_3Al , that uranium additions up to 3 at. % do not improve the hot hardness of thorium significantly, and that zirconium additions within the α -thorium solid solution range lead to solution hardening. In an alloy containing 22 at. % zirconium higher hardness values, up to 600°C, were obtained after solution annealing in the β (body-centered cubic) phase-field than after solution treatment in the $\alpha + \beta$ field. Additions of aluminum and uranium in excess of the solubility limit restrict the grain growth of thorium at 1150 and 1200°C, respectively. (auth)

12652 AERE-X/R-1503

General Electric Co., Ltd. Research Labs., Wembley, England.

THE EFFECT OF MERCURY ON THE CORROSION AND PROPERTIES OF VARIOUS MATERIALS. FINAL REPORT. PART 3. A SURVEY OF THE INTERACTIONS OF THE METALLIC ELEMENTS WITH STATIC LIQUID MERCURY AT ROOM TEMPERATURE AND 500°C. Report No. 11,727. J. F. Strachan and N. L. Harris. July 19, 1954. 45p.

A general survey of the interactions, saturated solubility, and weight loss of most metals in mercury is presented. Determinations were made at room temperature and at 500°C with annealed and unstressed samples. The complexity of Hg attack is noted, and various methods of overcoming ambiguities are discussed in relation to experimental technique. Data are tabulated. (J.R.D.)

12653 BM-RI-5465

Bureau of Mines, Bruceton, Penna.

CONVERSION OF NICARON NICKEL OXIDE TO NICKEL METAL. W. M. Mahan, N. B. Melcher, J. P. Riott, and E. J. Ostrowaki. Aug. 1958. 40p.

Nickel oxide was reduced to sponge Ni, which was then melted to produce specification-grade Ni ingots containing a minimum of 98.50% Ni plus Co and a maximum of 1.00% Co. Ni ingot metal containing 267,311 pounds of Ni plus Co was produced; the average analysis was: Ni, 97.54%; Co, 1.00%; Fe, 0.73%; S, 0.059%; and C, 0.07%. Of the Ni and Co contained in the NiO, 88.7% was recovered in the ingot metal, 7.7% was tied up in secondary products, and 3.6% was unaccounted for. (auth)

12654 BMI-1333

Battelle Memorial Inst., Columbus, Ohio.

IRRADIATION OF CLAD GRAPHITE IN HIGH-TEMPERATURE HIGH-PRESSURE CO_2 . John C. Smith, William E. Murr, Ward S. Diethorn, and William H. Goldthwaite. Apr. 7, 1959. 29p. Contract W-7405-eng-92. \$0.75(OTS).

Graphite specimens fully clad with Type 310 stainless, Type 446 stainless, or Inconel were irradiated in a 1000-psi CO₂ environment for a period of 4 weeks at approximately 1300°F followed by 1 week at 1500°F. The fast-neutron-plus-gamma dose rate was estimated at 8×10^7 rads per hr. The gas environment was sampled and replenished eight times during the experiment. After 60 hr at about 1350°F, the CO content had increased from a negligible value to 3.6 vol. %. It then decreased steadily to a value of 0.4 vol. % at the end of 4 weeks. When the temperature was raised to 1500°F, the CO content increased to 1.9 vol. % in 100 hr and then decreased to 0.6 vol. %. The O content remained nearly constant throughout the experiment. Postirradiation examination and metallography revealed very little effect of the exposure on the cladding materials at the gas and graphite interfaces. (auth)

12655 BMI-1335

Battelle Memorial Inst., Columbus, Ohio.
EFFECTS OF IRRADIATION ON STAINLESS STEEL-CLAD UO₂ PELLETS IN HELIUM OR CARBON DIOXIDE. Gerald E. Lamale, John E. Gates, and Ronald F. Dickerson. Apr. 21, 1959. 18p. Contract W-7405-eng-92. \$0.75(OTS).

Uranium dioxide pellets sealed in Type 316 stainless steel containers with a helium gas were irradiated in helium and in CO₂ in thermal fluxes of the order of 1×10^{13} n/(cm²)(sec). Cladding-surface temperatures were reportedly between 1200 and about 1800°F. The hot-cell examination performed by BMI showed that there were no obvious effects of the irradiation on the specimen tested in helium. However, the specimen irradiated in the presence of CO₂ exhibited severe cladding-CO₂ reaction and possible central melting of the UO₂. Although comparisons between pre- and postirradiation data were difficult because of involved fabrication history of the specimens, the tests did further establish the fact that helium is a satisfactory coolant gas for stainless steel cladding material at a temperature of 1200°F. The data obtained from the specimen tested in the presence of CO₂ indicate that at temperatures in the range of 1600 to 1800°F Type 316 stainless steel is not compatible with CO₂. (auth)

12656 CRMet-806

Atomic Energy of Canada Ltd., Chalk River, Ont.
BEHAVIOUR OF Al-Ni SHEATHING ON UO₂ FUEL ELEMENTS IRRADIATED IN HIGH TEMPERATURE WATER (X-2h TEST). F. H. Krenz and A. E. Hunton. Nov. 1958. 75p. (AECL-758). \$1.50(AECL).

Methods have been developed for the fabrication of fuel elements consisting of UO₂ pellets sheathed in aluminum-nickel alloy tubing. Corrosion resistant end-closures were made by hot pressure welding. The corrosion behavior of these elements has been determined in an exposure for two reactor cycles in the X-2 loop in NRX Reactor. Loop conditions were: deionized water at 280°C flowing at 18 ft/sec over the fuel sheaths. Heat fluxes through the sheaths varied from 11.4 to 68.5 watts/cm². The corrosion of the sheaths in this exposure was severe. A penetration of roughly 7×10^{-3} inches was measured after the first reactor cycle (21 days). The penetration was much less during the second cycle for moderately rated elements (11–12 watts/cm²) but again about 7×10^{-3} inches for a highly rated element (68.4 watts/cm²). It could be concluded that an increased heat flux resulted in an increased rate of sheath penetration, the increase from ~12 watts/cm² to ~70 watts/cm² approximately doubling the penetration. It is now known that the corrosion observed in this experiment was more severe than would have been found in a system containing a much larger area of corroding aluminum. The severe pitting and erosion of the X-2(h) samples are known to be characteristic of corrosion in a system containing a small area of aluminum in a large volume of purified water. The X-2(h) test was therefore not typical of conditions in a reactor with aluminum-nickel sheathed fuel. (auth)

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12657 CRMet-824

Atomic Energy of Canada Ltd., Chalk River, Ont.
CREEP AND TENSILE PROPERTIES OF MAGNESIUM ALLOY AZ61 AT 50°C. L. G. Bell. Dec. 1958. 28p. (AECL-779). \$1.00(AECL).

The creep properties of magnesium alloy AZ61 in the as-extruded condition were determined at 50°C and several stresses between 10,000 psi and 35,000 psi. Samples were cut transversely and longitudinally from extruded tube, and longitudinally from extruded rod. Extrapolation of minimum creep rates indicates that at 50°C the requirement of a secondary creep rate less than 1×10^{-6} %/hr is met by the alloy at 10,000 psi. The transverse ultimate tensile strength of the tube at 50°C was found to be 34,800 psi; this limits the allowable working stress to 8,700 psi. (auth)

12658 DMIC-Memo-11

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
BELT GRINDING OF TITANIUM SHEET AND PLATE. Carl T. Olofson. Mar. 15, 1959. 8p.

Successful grinding of titanium with abrasive belts depends on reducing its welding action to the mineral and requires controlled fracture wear of the abrasive grits in order to supply constant sources of cutting edges during grinding. Titanium sheet can be belt ground to close dimensional tolerances. Belt grinders have produced flat surfaces with only 0.004-in. maximum deviation over areas up to 36 × 36 in. The cost of grinding titanium is estimated to be 6 to 10 times that for stainless steel. (J.E.D.)

12659 DMIC-Memo-12

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

SOME METALLURGICAL CONSIDERATIONS IN FORGING MOLYBDENUM, TITANIUM, AND ZIRCONIUM. Harry B. Goodwin. Mar. 25, 1959. 43p.

Presented at the Master's Conference—Shop 23, Portsmouth, Virginia, October 18, 1958.

Reasons for the current interest in molybdenum, titanium, and zirconium are outlined briefly, and typical uses are cited. The forging of each metal is discussed separately. In each case the metallurgy of the metal is reviewed briefly and the effect of the metallurgical characteristics on forging practice is explained. Practical hints on forging each metal are also given. (auth)

12660 DMIC-Memo-13

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

JOINING OF BERYLLIUM. N. E. Weare and R. E. Monroe. Mar. 30, 1959. 28p.

Beryllium is a brittle metal and consequently is difficult to fabricate and join. Limited success has been reported on direct welding by tungsten-arc, pressure, and electron-beam processes. Cracking is the major problem encountered. Resistance spot welds have been made, but little is known about the properties of these

welds. Good joints have been made by braze welding with aluminum filler and brazing with silver and the silver-copper eutectic alloy. Improvements in base metal and in joining techniques are required. (auth)

12661 DMIC-Memo-15

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

MECHANICAL- AND PHYSICAL-PROPERTY DATA ON MODIFIED 12 PER CENT CHROMIUM MARTENSITIC STAINLESS SHEET STEELS FOR AIRFRAME APPLICATIONS. J. G. Hoag, D. B. Roach, and A. M. Hall. Apr. 18, 1959. 58p.

Mechanical and physical property data of chromium martensitic stainless steels, of interest to the airframe industry, are reported. The composition of the steel has been so modified by alloying additions as to give improved mechanical properties. The properties presented are principally for sheet material. (J.E.D.)

12662 HW-60043

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] MARCH 1959. L. H.

McEwen, comp. Apr. 15, 1959. 35p. Contract W-31-109-Eng-52. \$6.30(ph), \$3.00(mf) OTS.

Plutonium Recycle Program. The preparation PuC, PuO₂, and graphite in the correct stoichiometric proportions is reported. Physical mixtures of UO₂-PuO₂ were fired at 1600°C for eight hours to provide the final data on solubility in the system UO₂-PuO₂. Compacts of Al₂O₃, MgO, and ZrO₂ have been sintered to densities ranging from 80 to 90% of theoretical. Billets were cast in order to obtain fabrication and corrosion data on Al-Pu alloys of modified matrix composition. The extrusion of Al-Pu rods is continuing. Twelve full-length PRTR Al rods clad with Zircaloy tubing have been tested to investigate assembly, wrapping, autoclaving, and warp-age problems. Vibratory compaction of high-density UO₂ grains into metal tubes is being studied as an alternate method of fabrication of fuel elements. Post-irradiation examination of fuel elements is reported. The heat of reaction of Zircaloy-2 in HNO₃-HF etch solution is reported. Examination was begun on a four-rod Zircaloy-2 clad, Al-Pu alloy fuel element cluster which was irradiated to ~2000 MWD/T. Heat transfer characteristics of the PRTR fuel element is being investigated. Calculations of water loss rates following a piping failure in the PRTR were completed with consideration of ruptures of the top header, top jumper, and bottom jumpers. Chemical Research and Development Operation. Work has continued on both the direct reduction of PuO₂ and the in situ conversion of it to chloride followed by reduction with Zn-Mg. The effect of U concentration on the distribution in the KCl-AlCl₃-Al system was examined. Physics and Instruments Research and Development Operation. Using Mummery's method, the PCTR-derived values of K_u and f for various PRR lattices have been analyzed. Fabrication of the warp measurement unit for the profilometer was completed. Programming Operation. A detailed study of a schedule for charging, discharging, and chemical processing of PRTR fuel was completed. Basic Swelling Studies Program. Capsules are being designed for irradiation of unrestrained U specimens in the MTR and ETR. Uranium swelling has been simulated in the laboratory by the introduction of Xe gas into U by cathodic glow discharge at high temperatures. The diffusion of rare fission gases through the U

lattices is being studied. Graphite Studies. Surface area and pore size measurements were completed on four TSGBF graphite samples prior to outgassing and reactor irradiation at 550°C in high-pressure CO₂. Preliminary screening tests were completed on a siliconized impregnated and a siliconized graphite. (For preceding period see HW-59600.) (W.L.H.)

12663 KAPL-1479

Knolls Atomic Power Lab., Schenectady, N. Y.

DEVELOPMENT OF CERAMIC COATINGS FOR

URANIUM. G. L. Ploetz and H. G. Sowman. Jan. 17, 1956. Decl. Apr. 6, 1959. 27p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

Glass compositions and application methods suitable for porcelain enamel coatings on uranium have been developed. Best results were obtained with compositions within the Na₂O-PbO-SiO₂ and Na₂O-PbO-TiO₂-SiO₂ systems, with small additions of CuO and/or NiO to improve the adherence of the coatings to uranium. Data are presented on the adherence, thermal expansion, thermal resistivity, softening temperature, density, and thermal neutron absorption cross section of the glasses that were developed as a result of this investigation. The compositions reported are limited to low melting glasses that fuse below the alpha-to-beta uranium transformation temperature of 660°C. (auth)

12664 KAPL-1609

Knolls Atomic Power Lab., Schenectady, N. Y.

DEVELOPMENT OF CERAMIC COATINGS FOR

URANIUM AND THORIUM. G. L. Ploetz and C. W.

Krystyniak. Sept. 1956. Decl. April 6, 1959. 11p.

Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

Full-size Hanford uranium slugs have been successfully coated with vitreous porcelain enamels with consistently good results. Uranium-1.5 at. % silicon alloy and uranium-0.5 at. % chromium alloy disks and slugs were amenable to coating by the same techniques used with unalloyed uranium. Glasses of beryllium fluoride base were developed as low-temperature uranium coatings, but these had poor corrosion resistance and softening temperatures too low for the present application. Thorium metal strips, disks, and small slugs were coated with less difficulty than uranium or uranium alloys. Thorium did not oxidize as rapidly during the firing operation and did not require electropolishing as a pretreatment before enameling. (auth)

12665 LA-1524

Los Alamos Scientific Lab., N. Mex.

A REVIEW OF THE CORROSION OF URANIUM AND

ITS ALLOYS. James T. Waber. Nov. 7, 1952. Decl. June 13, 1956. 46p. Contract W-7405-eng-36. \$7.80 (ph), \$3.30(mf) OTS.

One characteristic of the corrosion of uranium is the accelerating destruction of the metal under both dry and humid conditions and throughout a wide temperature range. Another corrosion property is the fracturing and fragmentizing of the oxide products. This results in an accelerating or decelerating growth law being operative at a particular time. This time is determined by whether the oxide ruptures rapidly or slowly compared to the rate of growth of the unfractured oxide. The reaction with dry air is essentially a reaction with the contained oxygen. In water, under oxygen-free conditions, linear oxidation laws are observed. In steam, because UO₂ is the product at temperatures below 250°C and U₃O₈ at temperatures above 250°C, different reaction rates occur in the two temperature ranges. The effects

of a few alloying elements on the corrosion resistance of uranium are reviewed. Wartime research indicates that small additions of aluminum, molybdenum, nickel, and titanium have a slightly beneficial effect. Niobium, silicon, and zirconium increase substantially the corrosion resistance to water provided the alloy has had adequate heat treatment. There is some information that the addition of small amounts, less than 2%, of aluminum or silicon increases the resistance of uranium to oxidation in air. A ternary alloy containing 2.2% niobium and 0.5% zirconium was found to have even greater resistance. (auth)

12666 LMSD-2260

Lockheed Aircraft Corp. Missile Systems Div.,
Palo Alto, Calif.

BERYLLIUM. A Search of the Unclassified Literature. Wanda G. Bradshaw. Nov. 1, 1957. 57p. Contract NOrd-17017.

A search of the literature on beryllium metal was made in order to present in a comprehensive form the sources of information available in the unclassified literature. The search covered topical and progress reports and journal references, with emphasis on the period 1947 to 1957. References to compounds of Be such as the carbide, oxide, or nitride were excluded from the scope of this report. References to Be-Cu alloy were not included with the exception of irradiation effects. Only those references on Be toxicology and safety which appeared to be of interest to the laboratory worker or engineer were included. The literature on the analytical chemistry of Be was so extensive that it was not summarized. (auth)

12667 LS-41

Israel. Atomic Energy Commission, Tel-Aviv.
AQUEOUS CORROSION OF ALUMINIUM AT ELEVATED TEMPERATURES. A Preliminary Literature Survey. Joseph Yahalom. Dec. 1958. 25p.

A literature survey is presented which is intended to give a general idea of the Al corrosion problems discussed in the literature and present the suggestions offered by some authors. The sources are listed in the bibliography. The papers were selected, and only those dealing closely with the subject are given. (J.R.D.)

12668 MAB-142-M

National Research Council. Materials Advisory Board.
WELDABILITY SCREENING PROCEDURES AS RECOMMENDED BY THE WELDABILITY WORKING GROUP OF THE MAB SUBPANEL ON EVALUATION OF THE DEPARTMENT OF DEFENSE TITANIUM ALLOY SHEET ROLLING PROGRAM. Apr. 20, 1959. 15p. Contract DA-36-039-sc-76436.

Uniform testing procedures of weldability screening of several high-strength titanium sheet alloys for adaptability to airframe application are reviewed. (J.E.D.)

12669 MAB-144-M

National Research Council. Materials Advisory Board.
STRAIN EFFECTS SCREENING PROGRAM AS RECOMMENDED BY THE STRAIN EFFECTS WORKING GROUP OF THE MAB SUBPANEL ON EVALUATION OF THE DEPARTMENT OF DEFENSE TITANIUM ALLOY SHEET ROLLING PROGRAM. Apr. 21, 1959. 13p. Contract DA-36-039-sc-76436.

Limited tests and checks are recommended for determining effects of straining in tension on the tensile and compressive strength of titanium sheet alloy. (J.E.D.)

12670 MSAR-Memo-136

MSA Research Corp., Callery, Penna.
CHLORIDE STRESS CORROSION WITH STAINLESS STEEL AND INCONEL. Progress Report IV. M. J. McGoff and C. J. Glaser. Nov. 7, 1958. 14p. Contract NObs-65426.

Stainless steel is susceptible to stress corrosion when exposed to chloride bearing water. Nuclear naval vessel piping may be damaged from bilge water splashing insulated piping, permeating the insulation and eventually contacting the pipe wall. A test apparatus was set up for this project to simulate this condition. The control tests conducted in this apparatus with 1 in. Type 304 stainless steel specimens have shown that chloride stress corrosion will result. Effort is being directed to combat the corrosion by surveying industrial practices and using this information to set up experimental procedures for testing promising preventive methods. The substitution of an alternative material for stainless steel has been suggested as a second course in the elimination of the potential hazard of chloride stress corrosion. Inconel has been put forth by the Bureau of Ships as an alternative material. Inconel pipe specimens have not corroded under the same conditions which resulted in corrosion with stainless steel specimens. Further testing with Inconel is being performed with heat treated specimens. (auth)

12671 NAA-SR-Memo-1514

North American Aviation, Inc., [Downey, Calif.]
A MODIFIED METHOD OF CATHODIC ETCHING FOR ADAPTATION TO REMOTE CONTROL APPLICATION. K. Imlah. Nov. 2, 1955. 23p. \$4.80(ph), \$2.70(mf) OTS.

A detailed description is presented of an apparatus for cathodically etching metal surfaces. The apparatus is adaptable to remote operations in a hot cell. The materials investigated thus far have shown promising results. Thorium and Th alloys require ~5 to 30 minutes bombardment to produce the desired etching effects. Some U and U alloys have also been investigated. (W.L.H.)

12672 NMI-4370 (Rev.)

Nuclear Metals, Inc., Concord, Mass.
EVALUATION OF ZIRCALOY-CLAD U-2 w/o Zr ALLOY TUBE NO. 29, EXTRUSION NO. 18389. D. F. Kaufman and R. G. Jenkins. Dec. 22, 1958. 42p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. \$6.30(ph), \$3.00(mf) OTS.

Evaluation data are presented to show that Tube No. 29 meets irradiation specifications in all characteristics except final straightness and maximum clad thickness in taper regions. The latter deviation from specification is considered unimportant by both Du Pont and NMI. The deviation from straightness specification is not considered serious by Du Pont since the tube can still be satisfactorily loaded for irradiation testing. Tube 29 was shipped to SRL on November 28, 1958 for irradiation testing to high burn-up (5-10,000 Mwd/T). Tube 29 and its companion for irradiation testing at SRL, Tube 30, are of comparable irradiation quality. Other tubes from the nine tube lot, namely, Tube Nos. 26 and 31 met the irradiation specification on bow more closely and at the same time required less draw filing than Tube Nos. 29 and 30. On this basis, preference was given to Tube Nos. 26 and 31 for the Chalk River irradiation test. (auth)

12673 NMI-4371 (Rev.)

Nuclear Metals, Inc., Concord, Mass.
EVALUATION OF ZIRCALOY-CLAD U-2 w/o Zr

ALLOY TUBE NO. 30, EXTRUSION NO. 18390. D. F. Kaufman and R. G. Jenkins. Dec. 23, 1958. 41p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. \$6.30 (ph); \$3.00 (mf) OTS.

Evaluation data are presented to show that Tube No. 30 meets irradiation specifications in all characteristics except final straightness and maximum clad thickness in taper regions. The latter deviation from specification is considered unimportant by both Du Pont and NMI. The deviation from straightness specification is not considered serious by Du Pont since the tube can still be satisfactorily loaded for irradiation testing. Tube 30 was shipped to SRL on December 2, 1958 for irradiation testing to high burn-up (5-10,000 Mwd/T). Tube 30 and its companion for irradiation testing at SRL, Tube 29, are of comparable irradiation quality. Other tubes from the nine tube lot, namely, Tube Nos. 26 and 31 met the irradiation specification on bow more closely and at the same time required less draw filing than Tube Nos. 29 and 30. On this basis, preference was given to Tube Nos. 26 and 31 for the Chalk River irradiation test. (auth)

12674 NMI-4372

Nuclear Metals, Inc., Concord, Mass.

EVALUATION OF ZIRCALOY-CLAD U-2 w/o Zr ALLOY TUBE NO. 26, EXTRUSION NO. 18386. D. F. Kaufman and R. G. Jenkins. Jan. 9, 1959. 34p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. \$6.30 (ph); \$3.00 (mf) OTS.

Evaluation data are presented which show that Tube No. 26 meets irradiation specifications in all characteristics except maximum clad thickness in taper regions and maximum outside diameter over core section. Neither deviation from specification is considered important by Du Pont. Tube No. 26 is considered the best tube in the nine tube lot from the point of view of over-all quality and has therefore been chosen for the irradiation test at Chalk River. It is being stored at NMI pending shipping instructions. The superiority of this tube over others in the nine tube lot is based on minimum final bow and the absence of surface imperfections (no draw filing was necessary). (auth)

12675 NMI-4380

Nuclear Metals, Inc., Concord, Mass.

EVALUATION OF ZIRCALOY-CLAD U-2 w/o Zr ALLOY TUBE NO. 34, EXTRUSION NO. 19658. W. J. Richmond and D. F. Kaufman. Jan. 7, 1959. 18p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. \$3.30 (ph); \$2.40 (mf) OTS.

Limited evaluation data are presented to show that Tube No. 34 is suitable for its intended use as a dummy tube to test out handling procedures in the Vallecitos reactor. The primary purpose of the extrusion was to check on the core length, which was found to be within specification. A slight memory effect was observable in the end seal areas since the end seals had not been heat treated prior to extrusion. The tube itself has not been heat treated and should not be irradiated. (auth)

12676 NP-7389

Mine Safety Appliances Co., Callery, Penna.

REPORT 1 ON FREEZE SEAL PERFORMANCE. Memorandum Report 55. T. A. Ciariariello and R. A. Tidball. May 4, 1954. 6p. Contract NObs-65426.

An apparatus was designed and operated to determine the parameters affecting natural circulation heat transfer rates in horizontal and inclined pipes. The experiments on 1 in. piping are reported. The results of the tests are shown as temperature variation along the test

section. The ambient temperature in the duct and the melting point of sodium are also indicated. (J.E.D.)

12677 NP-7390

Mine Safety Appliances Co., Callery, Penna.

THERMAL SHOCK—PRELIMINARY REPORT NO. 8: EQUIPMENT REVISION. EIGHT INCH WELDED FLANGE TEST. Memo Report 58. J. K. Richter and M. M. Shrut. June 10, 1954. Decl. Aug. 2, 1955. 15p. Contract NObs-65426.

As a result of system changes, extremely severe shocks can be imposed on a test specimen. An eight-inch flanged specimen has been subjected to stream changes of up to 380°F per second. Two leaks occurred in deeply drilled wall thermocouple holes. (auth)

12678 NP-7391

Mine Safety Appliances Co., Callery, Penna.

PERFORMANCE OF A FROZEN SODIUM SEAL ON A 120 GPM DURIRON CENTRIFUGAL PUMP. V. K. Heckel and E. C. King. June 28, 1954. 15p. Contract NObs-65426.

Experimental data indicated that the flow and pressure of the centrifugal pump met the design capacity. The motor was found to be inadequate in that seal friction accounted for 40% of the input. The second test indicated that seal leakage during operation was not excessive and the pump could not be started and stopped without raising the seal temperature. (auth)

12679 NP-7392

Mine Safety Appliances Co., Callery, Penna.

STAINLESS STEEL SHOT IN SODIUM. Memo Report 62. M. M. Shrut and J. K. Richter. July 1, 1954. 4p.

A stainless steel shot was tested for cementing effect in molten sodium. There was no discernable increased resistance to penetration by a rod, as evidenced by daily probing, over a six week soaking period. (auth)

12680 NP-7393

Mine Safety Appliances Co., Callery, Penna.

RADIOACTIVE LEAK EXPERIMENTS. Progress Report No. 3 [for] May 1 to July 1, [1954]. Memo 63. R. J. Campana and J. W. Mausteller. July 15, 1954. 5p. Contract NObs-65426.

Construction and testing of the experimental system for use in coolant leak tests are described. (J.R.D.)

12681 NP-7436

MSA Research Corp., Callery, Penna.

A STUDY OF METHODS FOR PREVENTION OF CHLORIDE STRESS CORROSION OF AUSTENITIC STAINLESS STEEL. Progress Report III. Memo Report 135. M. J. McGoff and C. J. Glaser. Aug. 20, 1958. 12p. Contract NObs-65426.

Stainless steel is susceptible to stress corrosion when exposed to chloride bearing water. The cracking of nuclear naval vessel piping may result from bilge water splashing insulated piping, permeating the insulation and eventually contacting the pipe wall. This project is to investigate the occurrence of chloride stress corrosion of Type 304 pipe from this action and to evaluate methods which will inhibit attack. A solution to the problem is being sought by experimental procedure and by a survey of industrial experience. (auth)

12682 RAD-SR-8-59-7

Avco Mfg. Corp. Research and Advanced Development Div., Wilmington, Mass.

BERYLLIUM JOINING; WADC SPONSORED PROGRAM. Quarterly Progress Report No. 2. E. M. Passmore. Jan. 13, 1959. 21p.

Preliminary work on the joining of beryllium to itself

by braze welding and fusion welding has indicated that successful braze welds can be made between $\frac{1}{8}$ -in. thick beryllium plates by placing strips of an aluminum-12 wt. % silicon alloy between them and passing an a-c argon-shielded tungsten arc along the joint. During this kind of braze welding, the beryllium plate alloys with the filler metal so that the fusion zone consists of a beryllium-aluminum-silicon alloy. Beryllium can be protected adequately from oxidation during fusion welding by welding in an atmosphere dry box filled with dried and purified argon. Dried and purified argon flows through the torch during welding. Preliminary results indicate that cracking and hot tearing are substantially reduced by preheating the beryllium to 1200°F before welding, although much porosity is present. (auth)

12683 RDB(C)-T/M-140

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England. SOLID-LIQUID VOLUME CHANGE IN URANIUM. I. P. Bell and J. Standring. Feb. 13, 1953. 4p.

The quench-casting method was used in experiments to determine the expansion of U due to temperature. The experimental method is described, and a diagram of the apparatus is included. Results are discussed, and in conclusion it is pointed out that the data obtained depend on the doubtful accuracy of liquid volume measurement. It is recommended that results be confirmed by an independent method. (J.R.D.)

12684 RDB(W)/TN-36

Gt. Brit. Windscale Works, Sellafield, Cumb., England. INVESTIGATIONS ON THE WELDING OF 1-INCH N.B. 18/13/1 STAINLESS STEEL PIPE BY THE HOT PRESSURE WELDING METHOD. G. O'Grady and E. K. Richardson. June 30, 1952. 17p.

An investigation was made on hot pressure welding of 1-in. stainless steel pipe. The application of welding variables and their effect on welding are discussed. (J.E.D.)

12685 RDB(W)/TN-82

Gt. Brit. Windscale Works, Sellafield, Cumb., England. THE DESIGN OF A SEAL-WELDED ALUMINIUM FLANGE WITH BOLTED MILD STEEL BACKING FLANGES. C. O'Grady and D. Shaw. July 1953. 21p.

The welding development work on the design of a seal-welded aluminum flange for 3 in. n.b. pipe is described. Recommendations are made for the design of flanges, and on the welding technique to be employed. It is concluded that a flange with a rim or lip 0.125 in. thick and 1.625 in. greater in diameter than the main body of the flange can be welded satisfactorily and the joint could be broken and rewelded a number of times. When the diameter of the lip is reduced after rewelding so that it no longer exceeds that of the main body of the flange by more than 1-inch it would be desirable to pre-heat prior to welding. (auth)

12686 SCNC-272

Sylvania-Corning Nuclear Corp., Bayside, N. Y. BONDING OF VARIOUS METALS AND ALLOYS BY ISOSTATIC PRESSING AT ELEVATED TEMPERATURES. J. Fugardi and J. L. Zambrow. Dec. 1958. Decl. Mar. 20, 1959. 37p. Contract AT-30-GEN-366. \$1.00(OTS).

Operating temperatures of 1200°C enabled hot isostatic bonding of materials such as Zircaloy-2 to 8 wt. % U-Zr, Zircaloy-2 to 10 wt. % Nb-U, Nichrome to 35 wt. % UO_2 -Nb, 40 wt. % Ti-Nb to 30 wt. % UO_2 -Nb, and Al to 20 wt. % U-Al. A study was made of the bond strength of type 347 stainless steel in which the process

variables, e.g., pressure, temperature, and time, were varied. From the results it is concluded that the processing conditions of 1200°C, 12,000 psi for 20 min exceed the minimum conditions required for good bonding. (auth)

12687 WADC-TR-58-476

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THERMOPHYSICAL PROPERTIES OF SOLID MATERIALS. [Period covered] June 1, 1957 to July 31, 1958. Alexander Goldsmith and Thomas E. Waterman. Oct. 6, 1958. 430p. Project title: THERMOPHYSICAL DATA CONSOLIDATION. Task title: THERMOPHYSICAL DATA FOR SOLID MATERIALS. Contract AF33 (616)-5212. (AD-207905).

Thermophysical property data for a number of solid materials are presented in both graphical and tabular form, with all entries annotated. Materials included are generally those with melting points in excess of 1000°F. This volume is the partial result of the first year's effort in a program whose objective is the compilation, evaluation and consolidation of all primary test data published since 1940. Although this report is incomplete, it is representative of the end item. The reasons for its early distribution are to disseminate usable information on many important materials and to elicit comments and suggestions for improvement of the final product. (auth)

12688 WAPD-A1W(M)-1128

Westinghouse Electric Co. Bettis Plant, Pittsburgh. REVIEW OF PROGRESS ON THE DEVELOPMENT OF METALLURGICAL METHODS FOR JOINING Ag-In-Cd TO ZIRCALOY-2. R. M. Stackhouse and K. M. Goldman. Feb. 4, 1958. 20p. \$3.30(ph), \$2.40(mf) OTS.

Methods of direct welding, casting and extrusion, combination mechanical-welded joint, and weldment depositing were investigated for joining Cd-In-Ag alloy to Zircaloy-2. (J.E.D.)

12689 AEC-tr-3639

SELF-DIFFUSION IN SOLID LITHIUM. A. N. Naumov and G. Ya. Ryskin. Translated by S. J. Rothman (Argonne National Lab.) from *Zhur. Tekh. Fiz.* 29, 189 (1959). 5p. \$1.80(ph), \$1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in *NSA*, Vol. 13, as abstract No. 10118.

12690 AERE-Trans-11/3/5/1105

ELECTRON-MICROSCOPE INVESTIGATION OF GRAIN STRUCTURE OF SINTERED MATERIALS BY FRACTURE SURFACE ANALYSIS. Hermann Pfisterer. Translated by M. C. Hartnell-Beavis (U.K.A.E.A., Atomic Energy Research Establishment) from *Siemens-Z.* 25, Nos. 5/6, 199-205(1955). 16p. (Figures omitted). \$1.80(ph), \$1.80(mf) JCL or LC.

The investigation of the grain structure of sintered materials produced by powder metallurgy methods is traced from the early inspection methods through the electron-microscope investigation. (W.L.H.)

12691 CEA-tr-A-399

LE COMPORTEMENT À LA CORROSION DE L'AL PUR EN FONCTION DE LA RUGOSITÉ DE LA SURFACE ET DE L'ÉPAISSEUR DE LA COUCHE D'ELOXAL. (The Corrosion Behavior of Pure Al as a Function of the Roughness of the Surface and the Thickness of the Eloxal Layer.) R. Lattey and H. Meunzig. Translated into French from *Aluminium* 32, 252-6(1956). 17p.

The metal quality and the layer thickness are essential for the corrosion resistance of aluminum sheathed

with eloxal deposit. Too thin layers of eloxal are often more harmful than their complete absence since the natural oxide film is a relatively good protector of aluminum. The surface roughness has a great influence on the corrosion sensitivity, which is explained by the high specific volume of the oxide. Several series of tests made on pure aluminum sheets having surfaces with different roughness confirmed the dependence of the corrosion resistance on the thickness of the eloxal layer and the roughness. The protection given by the natural oxide film was also shown. Homogenization increases the corrosion resistance. (tr-auth)

12692 CEA-tr-A-454

DIFFUSION ET SOLUBILITÉ DE L'HYDROGÈNE DANS LE FER ET L'ARGENT. (Diffusion and Solubility of Hydrogen in Iron and Silver.) [Walter] Eichenauer (Eichnauer), [Herbert] Künzig, and [Albert] Pebler. Translated into French by R. Caboz from Z. Metallk. 49, 220-5(1958). 19p.

The coefficients of diffusion and solubility of hydrogen in α -iron and the diffusion coefficient of hydrogen in silver were measured. Metallic spheres, 1 cm in radius, filled with hydrogen are degassed and the hydrogen collected. From the determination of the pressure increase in the hydrogen receptacle as a function of time, the diffusion and solubility coefficients were found. For iron the diffusion coefficient in the temperature range from 200 to 774°C was determined as $D = 0.93 \times 10^{-3} \times e^{-2700/RT}$ and the solubility coefficient was $L = 0.77 \times 10^{-3} \times e^{-5800/RT}$. The diffusion coefficient of hydrogen in silver was $D = 2.82 \times 10^{-3} \times e^{-7500/RT}$ in the temperature range from 388 to 600°C. (tr-auth)

12693 CEA-tr-A-527

LA VITESSE D'OXYDATION DU FER PUR DANS L'OXYGÈNE SOUS PRESSIONS RÉDUITES ET DANS LE GAZ CARBONIQUE. (The Oxidation Velocity of Pure Iron in Oxygen Under Reduced Pressure and in Carbon Dioxide Gas.) N. G. Schmahl and H. Baumann. Translated into French from Arch. Eisenhüttenw. 29, 147-52(1958). 22p.

The velocity of the oxidation of electrolytic iron was investigated in oxygen at 950°C between 2 and 760 mm Hg. Between 76 and 760 mm it was established that the oxidation is a function of the pressure following a parabolic law. At 2 mm the oxidation law is linear. An equation relating the oxidation to the pressure was derived. The oxidation of pure iron in a current of carbon dioxide was also studied at 950 and 981°C. The results were compared with the measurements of previous investigators. (tr-auth)

12694 CEA-tr-R-617

OXYDATION DU CHROME À L'AIR ET DANS L'OXYGÈNE. (Oxidation of Chromium in Air and Oxygen.) V. I. Arkharov, V. N. Konev, I. Sh. Trakhtenberg, and S. V. Shumilina. Translated into French by B. Vinogradoff from Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R., Ural'. Filial 5, 190-1(1958). 6p.

The oxidation of chromium in air and oxygen was studied at different temperatures by an investigation of the kinetics of the formation of the corrosion deposits, the composition and structure of the deposit layer, and the microtexture of the layers. The characteristic rays of the rhombohedral oxide Cr_2O_3 were revealed by the Debye diagrams, and a microscopic study confirmed the existence of a single phase in the oxide layer of chromium oxidized in oxygen. The chromium oxidized in air showed supplementary diffraction patterns, and

metallographic analysis confirmed the existence of two distinct layers. The second layer was shown to be the hexagonal nitride Cr_2N . The oxidation rate is slower in air than in oxygen. (J.S.R.)

12695 NP-tr-227

STUDY OF THE SUPERSTRUCTURE OF Ni_3Fe BY A NEUTRON DIFFRACTION METHOD. B. G. Lyashchenko (Liashchenko), D. F. Litvin, I. M. Puzei, Yu. (Ju.) G. Abov. Translated for Lincoln Lab., MIT from Russian Monograph, Met. i Metalloved.; Trudy Konf. 452-8(1958). 9p.

The superstructure of Ni_3Fe was studied by neutron structural analysis of single crystal samples without preliminary monochromatization of the radiation. Neutron scattering results are tabulated, and the effects of various sample treatments are presented graphically. (J.R.D.)

12696 SCL-T-244

TRANSFORMATIONS IN THE MIDDLE PART OF THE SYSTEM Al-Mg (EXCERPTS). (O Prevrashcheniyakh v Sredney Chasti Sistemy Al-Mg.) N. S. Kurnakov and N. I. Mikheeva. Translated by Marcel I. Weinreich (Sandia Corp.) from Izvest. Sektora Fiz. Khim. Anal., Inst. Obshchei Neorg. Khim. Akad. Nauk S.S.S.R. 13, 209-24(1940). 17p. \$3.30 (pb), \$2.40 (mf) JCL or LC.

Data are presented on electric conductivity of Mg-Al alloys with varying amounts of Mg as a function of temperature. Phase diagrams are presented for Mg-Al alloys of various compositions. (W.L.H.)

12697

URANIUM AND ITS ALLOYS. G. Ya. Sergeev and V. V. Titova. Atomnaya Energ. 6, 253-60(1959) Mar. (In Russian)

The physico-mechanical properties of uranium and its alloys are reviewed on the basis of data presented at the Second Geneva Conference. Radiation effects on uranium, especially gas swelling, are discussed. The α and γ phases of uranium and other fission alloys are described. The temperature maxima of uranium-base solid fuel elements are analyzed. Data are given from metallographic investigations. (tr-auth)

12698

EFFECTS OF NEUTRON IRRADIATION ON THE STRUCTURE AND PROPERTIES OF FERRITOPERLITE STEELS. V. S. Lyashenko and Sh. Sh. Ibragimov. Atomnaya Energ. 6, 277-80(1959) Mar. (In Russian)

Irradiations of specimens of thermosensitive steel and steel with niobium (thermoresistant) resulted in improved mechanical properties of the first set of specimens irradiated at 500 to 600°C; the latter specimens did not exhibit any alteration in its properties. The metallographic studies indicated that the improved mechanical properties are caused by structural changes induced by peak shifts in the irradiated materials. (tr-auth)

12699

PRODUCTION OF LITHIUM HYDRIDE POWDER. J. Novotný and M. Novotná (Karlsuniversität, Prague). Collection Czechoslov. Chem. Commun. 24, 989-91(1959) Mar. (In German)

A method for the production of lithium hydride powder is described. Lithium carbonate was converted into the chloride. From a saturated solution of the chloride lithium amalgam was produced by electrolysis. The lithium amalgam was then converted into the hydride by heating the amalgam in a hydrogen atmosphere. The apparatus used for the reaction of the

lithium amalgam is described, and the conditions are given. At a reaction temperature of 600°C, a yield of 87% is obtained. The product was light gray and crumbled to powder at a light pressure. (J.S.R.)

12700

THE MECHANISM OF OXIDATION AT HIGH TEMPERATURES OF AUSTENITE STEEL WITH 18% Cr-8% Ni. Jacques Béhard, Jean Hertz, Yves Jeannin, and Jean Moreau. *Compt. rend.* **248**, 2095-7(1959) Apr. 6. (In French)

The oxidation of Cr-Ni steel was investigated at 1050°C by a kinetic study and microscopic, x-ray, and electron diffraction examination. The results show that the oxidation has an initial period of slow oxidation. This period of oxidation follows a parabolic law. The oxide film formed appears to protect the alloy for a time. Then the second period of oxidation occurs which is characterized by a rapid oxidation. This period continues until the elimination of iron from the chromium-poor layer is achieved. Then the third period, characterized by a slow oxidation, appears. (J.S.R.)

12701

CHARACTERISTICS OF A MARTENSITE PHASE OBTAINED IN URANIUM-MOLYBDENUM ALLOYS. Jeanne Lehmann. *Compt. rend.* **248**, 2098-2100(1959) Apr. 6. (In French)

The formation conditions of a martensite phase from U_γ solid solutions were determined. The structure of this phase, α'_1 , is monoclinic. (tr-auth)

12702

MECHANISM UNDERLYING THE INCREASE OF FATIGUE STRENGTH OF ELASTO-PLASTIC MATERIALS LIABLE TO HARDEN ON CYCLIC DEFORMATION, DUE TO THE ACTION OF STRONG SURFACE ACTIVE COMPOUNDS. M. I. Chaevskii (Inst. of Mechanics and Automatics, Academy of Sciences, Ukrainian S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 319-22(1959) Apr. 11. (In Russian)

Experiments were carried out in order to show the negative effects of Pb-Su eutectic (at 300°C) alloys on the fatigue limits in steel. (R.V.J.)

12703

CONTINUOUS SOLID SOLUTIONS IN THE Co-Ni-B SYSTEM. I. I. Kornilov and P. T. Kolomytsev (Zhukovskii Air Force and Engineering Academy). *Doklady Akad. Nauk S.S.S.R.* **125**, 325-6(1959) Apr. 11. (In Russian)

Experimental studies were carried out with specimens of Co_3B - Ni_3B and Co_2B - Ni_2B . The x-ray and microstructure analyses indicate the presence of continuous metalloid solid solutions between the lower borides Co_3B , Ni_3B , Co_2B , and Ni_2B . (R.V.J.)

12704

X-RAY STUDY OF THE DECOMPOSITION OF OVERSATURATED SOLID SOLUTIONS CHARACTERIZED BY POOR SOLUBILITY. DECOMPOSITION OF AN OVERSATURATED SOLID SOLUTION OF COPPER IN GERMANIUM. A. M. Elistratov and P. R. Kamadzhiev (Inst. of Semiconductors, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 538-41 (1959) Mar. 21. (In Russian)

X-ray-diffraction studies were made of the decomposition of oversaturated solid solutions of Cu and Ge in the region of anomalous scattering at the matrix reverse lattice point. Oversaturated specimens of Cu and Ge were prepared by diffusion at maximum solubility temperature. Isothermal decomposition was studied at

550, 625, and 670°C. The double diffraction effects are shown on diagrams of isothermal decomposition of Cu in P-Ge at the (220) lattice point at 550°C, after annealing at 890°C for 8, 16, and 36 hours and at 625°C after annealing at 890°C for 15 and 45 min. (R.V.J.)

12705

X-RAY DIFFRACTION STUDY OF VANADIUM-GERMANIUM ALLOYS. E. I. Gladyshevskii and Y. B. Kuzma (Frank L'vov State Univ.). *Dopovidi Akad. Nauk Ukr. R.S.R.* No. 11, 1208-11(1958). (In Russian)

Seven alloys of germanium containing 29.1 to 83.3 atomic % V were investigated by x-ray diffraction and metallographic methods. A new compound, V_5Ge_3 , was found. The compound has a structure of the Mn_5Si_3 type ($a = 7.280 + 0.002$ kX, $c = 4.960 + 0.02$ kX; $c/a = 0.676$; $x_V = 0.25$, $x_{Ge} = 0.61$). In quickly cooled alloys the compound V_5Ge_3 exists in equilibrium with Ge and V_3Ge . (auth)

12706

KINETICS AND MECHANISM OF HIGH-TEMPERATURE OXIDATION OF RHENIUM IN THE RECRYSTALLIZED AND COLD-WORKED STATES. V. A. Lavrenko (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian S.S.R.). *Dopovidi Akad. Nauk Ukr. R.S.R.* No. 11, 1216-20(1958). (In Russian)

The temperature dependence equation of the linear oxidation rate constants is calculated for the recrystallized and cold-worked states ($t = 400$ to 725°C). The slowest stages of the process are the kinetically indivisible stages of the electrochemical formation of rhenium oxides and their subsequent vaporization. (auth)

12707

A NEW TECHNIQUE FOR THE PREPARATION OF METALLOGRAPHIC SPECIMENS OF ZIRCALOY-2. A. Bassi and C. Corsetti (CISE, Milan). *Energia nucleare (Milan)* **6**, 147-53(1959) Feb.

A new chemical polish-etch method for metallographic preparation of Zircaloy-2 specimens is described. The resulting microscopic structure exhibits very high contrast. With this chemical etch it is also easy to reveal the dislocation structure of sub-boundaries. (auth)

12708

BERYLLIUM AND ZIRCONIUM. Marc Salesse (Commissariat à l'Énergie Atomique, Paris). *Inds. atomiques* **3**, No. 1-2, 65-76(1959). (In French)

A survey is made of the production and metallurgical properties of beryllium and zirconium. Both elements are of nuclear interest because of their low capture cross section. The problems encountered in the fabrication of each are reviewed. (J.S.R.)

12709

ACCELERATION OF LOW CARBON STEEL RECRYSTALLIZATION RATE. G. K. L'vov (Kiev Polytechnic Inst.). *Metalloved. i Termich. Obrabotka Metal.* No. 4, 8-14(1959) Apr. (In Russian)

An acceleration of the annealing recrystallization processes by high-speed heating (over 1000° per sec) and an increase of temperature within the critical range are suggested. (R.V.J.)

12710

EFFECTS OF LOW TEMPERATURE ROLLING ON MECHANICAL PROPERTIES OF AUSTENITE STEEL. N. N. Lyulichev and N. V. Pisareva. *Metalloved. i Termich. Obrabotka Metal.* No. 4, 19-22(1959) Apr. (In Russian)

The effects of rolling at $+100^\circ$, $+20^\circ$, and -183° on the mechanical properties of austenite steel 1X19H9T were studied. (R.V.J.)

12711

EFFECTS OF ALLOYING ON THE FRICTION PROPERTIES OF TITANIUM. I. S. Kaptyug and V. I. Syshchikov. Metalloved. i Termich. Obrabotka Metal. No. 4, 22-7(1959) Apr. (In Russian)

The friction properties of titanium and titanium alloyed in induction furnaces with Al, Cr, Fe, Mn, Pb, and Si were tested, and the microhardness and microstructure were analyzed at various phases. It was found that titanium and the investigated titanium alloys have low friction resistance (they wear 15 to 30 times faster than brass, bronze, or stainless steel). However, paired with brass or bronze they can be used at friction points with comparatively light loads. (R.V.J.)

12712

NITRATION EFFECTS ON STAINLESS STEEL CORROSION RESISTANCE. A. G. Andreeva and L. Ya. Gurevich. Metalloved. i Termich. Obrabotka Metal. No. 4, 34-40(1959) Apr. (In Russian)

Electrode potentials of 4X14H2B2 (0.42% C, 13.75% Cr, 12.6% Ni, 1.5% W, 0.5% Mo, 0.4% Si, and 0.7% Mn) and 4X14H2B2 (0.4% C, 13.5% Cr, 2.68% Ni, 2% W, 0.55% Si, and 0.55% Mn) in 0.01 N of sodium chloride solution were investigated. The 4X14H14B2M steel was nitrated at 560°C for 48 hours; ammonium dissociation was 25 to 35%. The 4X14H2B2 was nitrated at 600°C for 24 hours. The changes in nitrated steel corrosion resistance, depending on the depth of the layer, corresponds to the changes in the electrode potential. The layers with low corrosion resistance and lowered electrode potentials, found at a certain depth of nitrated steels, were composed of chromium nitrides and solid solutions, impoverished by chromium and nitrogen. (R.V.J.)

12713

CORROSION OF WELDED STAINLESS STEELS IN ACID SOLUTIONS. M. M. Kurtepov and A. S. Gryaznova (Inst. of Physical Chemistry). Metalloved. i Termich. Obrabotka Metal. No. 4, 41-4(1959) Apr.

The effects of thermal treatment on the corrosion resistance of 1X18H9T in argon arc-welded seams were analyzed. Specimens were quenched in water at 1050°C and stabilized at 850°C for 3 hours, then cooled in air. Comparisons were made with standard untreated specimens. Tests were made in boiling solutions of 57% nitric acid for 200 hours with solution changes after 100 hours. Results showed that thermal treatments lowered the corrosion resistance. Concentrated inter-crystalline corrosion was observed along the welded seams, with the deepest corrosion after repeated short-period heating at 650°C (2 hours). An increased corrosion rate was found in titanium-stabilized seams in acid oxidizing solutions; however, titanium stabilized and nonstabilized seams show the same intercrystalline corrosion after repeated, short-period heating. (R.V.J.)

12714

SURFACE SATURATION OF STEEL BY BORON FROM A GASEOUS MEDIUM. A. F. Zhigach, I. S. Antonov, M. A. Pchelkina, G. I. Yukin, A. S. Dobrodeev, and V. N. Matveev. Metalloved. i Termich. Obrabotka Metal. No. 4, 45-7(1959) Apr. (In Russian)

Borinated metallic surfaces saturated with diborane were studied in order to find the most favorable con-

dition for producing quality layers. It was determined that gas borinated surfaces can be obtained in 4 to 5 hours with B_2H_6 mixed with hydrogen at 800 to 850°C , the gas mixture ratio $\text{B}_2\text{H}_6 : \text{H}_2 = 1 : 75$, and a gas flow rate of 75 to 100 l/hour. The above procedure produces borinated layers of 200 μ in thickness with surface microhardness up to 3000. (R.V.J.)

12715

THE CORROSION RESISTANCE, ESPECIALLY THE CORROSION FATIGUE, OF NITRIDED TITANIUM STEEL. M. Tömöry (Technischen Universität, Budapest). Periodica Polytech. (Eng.) 2, 291-308 (1958). (In German)

A corrosive action, together with repeated stress, leads, in steel, to severe pitting. The corrosion fatigue strength of high strength and of soft steel was compared. From the standpoint of the corrosion fatigue, it is very advantageous for steel to withstand compressive stress. The internal compressive stress of the titanium steel investigated was 40 kg/mm². Its bending strength under alternating load was 45 kg/mm² in both air and water. In salt water the fatigue limit was smaller. The corrosion strength of nitrated carbon steel is somewhat smaller and the corrosion-proof phase much narrower than that of nitrated titanium or Cr-Al-Mo steel. (tr-auth)

12716

SELF-DIFFUSION OF ZINC IN MOLTEN ZINC BROMIDE. Lars-Erik Wallin and Arnold Ludén (Chalmers Technischen Hochschule, Goteborg). Z. Naturforsch. 14a, 262-4(1959) Mar. (In German)

The self-diffusion coefficient D^+ of Zn in molten ZnBr_2 was measured in the temperature range 400 to 640°C by means of a capillary method. $D^+ = 79 \times 10^{-3} \exp(-16060/RT)$ was obtained. D^+ is measured in cm²/sec and R in cal/mole/degree. At higher temperatures perturbations occurred by reactions between the salt melt and the vessel and by partial decay of the salt. (tr-auth)

12717

ON THE MECHANISM OF METAL CORROSION IN NARROW SLITS AND CREVICES. VI. MAGNESIUM AND SOME OF ITS ALLOYS. I. L. Rosenfel'd and I. K. Marshakov (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R., Moscow). Zhur. Fiz. Khim. 33, 411-15(1959) Feb. (In Russian)

A study was made of corrosion in narrow slits in magnesium and some of its alloys. It is shown that in the majority of cases these metals are subjected to more severe corrosion in the slits than in the bulk of the electrolyte. The slit corrosion assumes a more clearly expressed local character. The dependence of the corrosion rate on the size of the slit is expressed by a complicated curve, being characterized by the presence of maxima at definite slit values. The mechanism of the intensified corrosion of magnesium and its alloys in slits rests on the intensive stirring of the electrolyte by hydrogen bubbles and in the motion of the bubbles themselves, obstructing the formation of protective films and destroying existing ones, rather than on the hindrance to the diffusion of oxygen. Hence the intense corrosive breakdown of magnesium in slits is due to the work of microcells and to the change in the intensity of their functioning. The part played by macrocells in the development of "slit corrosion" of magnesium and its alloys, in contrast to the previously studied cases of slit corrosion, does not come to the fore, owing to its low effectivity. (auth)

12718

EFFECTS OF THERMAL WEAR ON THE STRUCTURE AND CATALYTIC ACTIVITY OF SYNTHETIC ALUMINOSILICATES. D. P. Dobyichin and T. F. Tselinskaya (All-Union Research Inst. of Oil Chemical Processes, Leningrad). *Zhur. Priklad. Khim.* **32**, 486-94 (1959) Mar. (In Russian)

The effects of annealing on the structure and activity of porous aluminosilicate catalyzers were studied at 500 to 1000°C. It was found that thermal treatment increases the structural porosity, followed by a volume distribution shift along the radii in the direction of larger pores. The thermal resistance of fine pore structures had a lower thermal resistance than the large-pore materials. The cracking property of the material remained practically constant while hydrogen redistribution drops, indicating the presence of two catalytically active centers. (R.V.J.)

12719

THEORY AND PRACTICES OF PYRO-REFINING OF TIN. N. N. Murach. *Zhur. Priklad. Khim.* **32**, 556-63 (1959) Mar. (In Russian)

Descriptions are presented of various methods of tin purification, and the results obtained by each method are analyzed. Refining by formation of intermetallics followed by separation of liquid phases, filtration from iron and arsenic in vacuum, and separation of tin from iron by silicon are compared. The designs of filter apparatuses are included. (R.V.J.)

12720

ALUMINUM DISSOLUTION IN ACIDS AND ALKALI IN SUPERSONIC FIELD. A. M. Grinberg. *Zhur. Priklad. Khim.* **32**, 563-6 (1959) Mar. (In Russian)

The acceleration of aluminum dissolution in alkali in contact with copper by the application of an ultrasonic field is described. The effects of the frequency and intensity of the ultrasonic field on the process are analyzed. (R.V.J.)

12721

ELECTROLYTIC PRECIPITATION OF NICKEL IN PRESENCE OF SULFONATED NAPHTHALENE. V. V. Ostroumov. *Zhur. Priklad. Khim.* **32**, 572-8 (1959) Mar. (In Russian)

Experimental data are presented on the properties of nickel electrodeposition. It is shown that smoothed-out surfaces are inherent to both shining and dull nickel depositions. The microhardness of the shining deposition is about twice that of the dull. Analysis is made of the expansion properties of the depositions. (R.V.J.)

12722

ELECTRODEPOSITION OF CHROMIUM FROM A TETRACHROMATE BATH. A. Ya. Ryaboi and M. A. Shluger. *Zhur. Priklad. Khim.* **32**, 588-95 (1959) Mar. (In Russian)

The process of chromium electrodeposition from tetrachromate electrolyte and the properties of products obtained are described. (R.V.J.)

12723

IMPROVEMENTS IN OR RELATING TO THE VACUUM MELTING OF HIGH-MELTING METALS AND ALLOYS BY MEANS OF AN ELECTRIC ARC. (to W. C. Heraeus G.m.b.H. Co.) British Patent 809,444. Feb. 25, 1959.

Two vacuum arc furnaces which make their own consumable electrodes are described. In one, Zr or Ti powder is mechanically pressed in the top of a tube at 2 to 10 kg/cm². As the powder compact rod moves down toward the arc chamber, it is degassed by argon sweep-

ing and by vacuum pumps. In the evacuated arc chamber it melts in an arc formed by current supplied from below. The bottom of the water cooled arc chamber may be lowered by a mechanism as the arc-melted ingot forms. The second furnace design differs from the first in that prefabricated rods of Ti or Zr electrode are introduced into a tube at the top and are arc welded together in one chamber, then degassed and melted as before. (T.R.H.)

12724

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR ARC MELTING UNDER REDUCED PRESSURE. (to W. C. Heraeus G.m.b.H. Co.) British Patent 809,561. Feb. 25, 1959.

A laboratory-scale arc melting furnace is described which is safe and easy to operate. It is made of three pieces. The top or head may be fitted with either a consumable or nonconsumable electrode. Handles on the head are equipped with controls for electrode and current; the current is supplied through the cooling water system attached to the handles. The central cylinder is fitted with a vacuum pump and hand-operated sample feeder. The bottom is adapted for attaching a water-cooled crucible. (T.R.H.)

12725

LIQUID METAL PURIFIER. (to Babcock & Wilcox Co.) British Patent 809,584. Feb. 25, 1959.

A cold-trap device for removing oxides from liquid-metal systems is described. It consists of a heat exchanger at the top and a cold chamber at the bottom. The heat exchanger is so arranged that incoming hot metal warms up outgoing cooled metal. As hot metal flows through the cool region where oxides are precipitated out, heat from it passes through a barrier which is cooled by double-tube helical coils. The inner tube is for coolant and the outer tube contains N₂ for heat conductivity and to prevent contact of liquid metal and coolant. The particular arrangement of the invention and its other features are such that severe temperature gradients are avoided, and thermal stresses in the structure are reduced. (T.R.H.)

12726

IMPROVEMENTS IN OR RELATING TO URANIUM ALLOYS. Peter Charles Leslie Pfeil (to United Kingdom Atomic Energy Authority). British Patent 809,597. Feb. 25, 1959.

The preparation and usefulness of a ternary U alloy containing 20% Nb, and 10% Mo are described. Annealing for 3 days at 1000°C is suggested. (T.R.H.)

12727

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF METALS. Peter Best (to United Kingdom Atomic Energy Authority). British Patent 809,693. Mar. 4, 1959.

The preparation of UO₂-metal oxide compacts or cermet is described. The other metal may be Cr, Mo, Ni, Fe, or Nb. The oxides are compacted and then heated together under reduced pressure or in inert atmosphere. If layers of oxide are compacted, metal forms between them bonding them. If the oxides are mixed, a cermet is obtained. (T.R.H.)

12728

METHOD OF REMOVING SCALE FROM ZIRCONIUM. (to Aktiengesellschaft Für Unternehmungen Der Eisenund Stahlindustrie). British Patent 809,892. Mar. 4, 1959.

Scale formed on Zr at high temperatures can be re-

moved by heating with an alkali metal hydrogen fluoride. The scale-covered Zr is dipped for 0.25 to 1 min in molten KHF_2 at 300°C in an Fe or Ni vessel. Then a cold water rinse followed by a second treatment with dilute HF (2 to 5%) or with 20 vol. % HNO_3 plus 5 vol. % HF, if needed, completes the procedure. Alternatively 1% of KMnO_4 , KNO_3 or $\text{K}_2\text{Cr}_2\text{O}_7$ may be added to the molten KHF. Also CsHF_2 may be used at 400°C for 0.25 to 2 min. (T.R.H.)

12729

PRODUCTION OF URANIUM. (to United Kingdom Atomic Energy Authority). British Patent 810,033. Mar. 11, 1959.

Reduction of UF_4 by Mg aided by an auxiliary oxidation reaction of Mg with KClO_3 to provide additional heat is described. In one example, where all the heat required is supplied, 440 g of UF_4 powder (75% is -60 mesh, 60% is -80 mesh, 50% is -100 mesh, and 40% is -200 mesh) are mixed with 109 g Mg and 24.5 g KClO_3 and packed in a CaO-lined Fe crucible. A 300.2 g ingot of U was obtained, 90% yield. $\text{K}_2\text{S}_2\text{O}_8$ or I_2 may be substituted for KClO_3 in another example of the process. The charge is ignited in each case by electrically heating a U wire in the charge. (T.R.H.)

12730

PROCESS FOR THE PRODUCTION OF MULTIVALENT METALS AND NON-METALS. (to National Distillers and Chemical Corp.). British Patent 810,428. Mar. 18, 1959.

A double-reduction process for producing Zr and Hf is described. The ZrCl_4 vapor is passed over a stirred bed of NaCl, ZrCl_2 , ZrCl_3 , and Na at 325 to 400°C. The product of this reaction, essentially NaCl and ZrCl_2 , is again reduced with Na to produce sponge. For Hf the first reduction is with Na at 200°C, and the second reduction with Na at 960° for 4 hr. (T.R.H.)

12731

METHODS OF AND APPARATUS FOR TREATING SOLID-LIQUID SYSTEMS. (to Western Electric Co., Inc.). British Patent 810,448. Mar. 18, 1959.

Apparatus for electromagnetically suspending and zone refining a metal rod is described. An electric current is passed through a rod of metal to be purified enclosed in a quartz tube. A carriage is provided for passing the rod between the pole faces of a strong electromagnet. The interaction of the magnetic field and electric field opposed at 90° causes a portion of the rod to be melted and suspended. Thus as this molten zone is caused to move along the rod impurities are exchanged across the liquid-solid interface. The regulation of currents and control of the apparatus are discussed along with some of the difficulties involved. A means for cooling the pole-faces is given. (T.R.H.)

12732

IMPROVEMENTS IN OR RELATING TO WELDING APPARATUS. Eric Kenneth Richardson (to United Kingdom Atomic Energy Authority). British Patent 811,216. Apr. 2, 1959.

A portable pipe-end welder is described. A bridge supporting the welding head is clamped onto the pipe, and the head rotates around the pipe. A switch causes the arc current to die out as the weld is terminated. (T.R.H.)

12733

IMPROVEMENTS IN OR RELATING TO WELDING APPARATUS. Eric Kenneth Richardson (to United

Kingdom Atomic Energy Authority). British Patent 811,217. Apr. 2, 1959.

A pipe-end arc-welding system with portable heads is described which can be set up to weld different thicknesses according to the weld desired. The control system is described in detail. (T.R.H.)

12734

METHOD OF PRODUCING ELECTROLYTICALLY A BRIGHT FINISH ON A URANIUM OR URANIUM-RICH METAL SURFACE. (to United Kingdom Atomic Energy Authority). British Patent 811,432. Apr. 8, 1959.

An electrolytic bright polishing procedure for U and U-rich alloys is given. After degreasing in acetone, the U is suspended in an electrolyte of 10% aqueous Na_2CO_3 at 80°C. A supporting rack for this purpose is described. Electrolysis for 10 min at 60 amp/ft² using mild steel cathodes removed oxide and scale. A second electrolysis at room temperature using a graphite electrode in 10% aqueous citric acid at 3 amp/ft² for 1 min produced a bright silvery finish. Alternatively the first electrolysis may be done in an aqueous solution 20% NaOH and 7.5% citric acid at 80°C and a current density of 60 amp/ft² for 30 min. Also, a 10% tartaric acid solution may be used for the second electrolysis at 15 amp/ft² for 1 min. (T.R.H.)

12735

CERAMIC MATERIALS FOR RADIATION SHIELDING. (to The Plessey Co., Ltd.) British Patent 811,782. Apr. 15, 1959.

A ceramic shielding tile containing Pb and Ba is described. In one composition, 25 parts BaSO_4 , 75 parts PbSiO_3 , and $\frac{1}{2}\%$ bentonite are pacted, molded, and fired at 800°C. If the bentonite is omitted and it is fired at 1100°C a material suitable for radiation of 75 kev or less is obtained. Another composition is given which was compared with lead for broad and narrow beam x rays: BaOCO_2 , 27 parts; SiO_2 , 8 parts; PbO (SiO_2)₂, 48 parts; and ZrO_2 , 17 parts. This composition was fired at 1110°C. A 1-cm thickness of this ceramic was equivalent to ~1.6 mm Pb at zero distance, increasing to 1.9 mm Pb at 50 cm. These ceramic shielding tiles may be lead glazed to present an easily cleaned presentable surface, and they may be bonded together by a litharge cement. (T.R.H.)

12736

IMPROVEMENTS IN OR RELATING TO URANIUM ALLOYS. Norman Percy Allen and John Douglas Grogan (to United Kingdom Atomic Energy Authority). British Patent 811,841. Apr. 15, 1959.

The amounts of Al, Si, P, Sn, Pb, Bi, Nb, and Zn which can be added to vacuum-molten U to improve its physical and mechanical properties are given. The amounts given do not increase the competitive neutron absorption by more than 0.1%. (T.R.H.)

12737

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR FORMING INGOTS BY ELECTRIC HEATING. Robert James Garmy (to Republic Steel Corp.). British Patent 811,917. Apr. 15, 1959.

An arc furnace for producing large ingots of Ti or Zr is described. The induction-heated crucible is rolled on tracks under a cylindrical shell and raised up by jacks to fit the opening in the bottom of the shell. The shell is fitted with viewing means and electrodes. The electrode arrangement includes motors and gear systems for turning the electrodes and raising and lowering them to maintain a constant arc length. The operation of the

furnace may be carried out in an inert gas atmosphere. Thus, in operating the furnace, scrap metal is put in the crucible and the crucible is fitted to the shell and inert gas scavenging proceeds. More metal is fed through the top as required. The electrodes are actuated to move in paths controlled by a mechanism so as to cover the surface of the melt. As the amount of melt increases, the coverage by the arcs can be reduced. The arc current plus the induction coil current cause a motion in the melt which makes for a homogeneous fine-grained ingot. (T.R.H.)

12738

IMPROVEMENTS IN OR RELATING TO CRUCIBLES FOR MELTING METALS. Robert James Garmy (to Republic Steel Corp.). British Patent 811,918. Apr. 15, 1959.

A crucible for an electric arc furnace which produces large ingots of Ti or Zr is described. The crucible is cylindrical, mounted on jacks for raising and lowering, and mounted on wheels for moving under an electrode arrangement. It is surrounded by an induction coil which, with the arc current in the melt, causes a stirring motion which leads to a fine-grained homogeneous melt. The magnetic field of this coil also stabilizes the arcs from the electrodes. A water jacket for cooling is also provided. (T.R.H.)

12739

METHOD AND APPARATUS FOR THE CONTINUOUS PRODUCTION OF METALLIC BERYLLIUM. (to The Beryllium Corp.). British Patent 812,702. Apr. 29, 1959.

A process and apparatus for continuous electrolytic production of Be without a pre-electrolysis are presented. The fused-salt electrolytic bath, consisting of 55% BeCl₂ and 45% NaCl, is contained in a large Ni tank at 350 to 375°C. The graphite anodes are suspended inside the cathodes, Ni cylinders, open at the bottom and lined inside with graphite. The process is continuous in that the Be dendrites electrolytically formed on the graphite sleeve are knocked off by a disk lowered between the electrodes, fall to the bottom, and are scraped to a perforated bucket in a sump at one side of the tank and periodically lifted out of the tank. Such a unit is described which produced Be, without pre-electrolysis, of a purity which compared favorably with that produced conventionally. (T.R.H.)

12740

IMPROVEMENTS IN OR RELATING TO ALUMINIUM ALLOYS. Roy Alfred Ulfketel Huddle, Nigel John Murray Wilkins, and Colin Frederick Britton (to United Kingdom Atomic Energy Authority). British Patent 812,985. May 6, 1959.

The corrosion resistance of Al-Ni is improved by addition of 0.1 to 0.3 wt. % Ti with or without 0.005 to 0.1 wt. % Be. A vacuum anneal further improves the corrosion resistance. Specifically, two Al alloy compositions (1.75 wt. % Ni, 0.75 wt. % Fe, 0.15 wt. % Si, and 0.15 wt. % Ti; 1.75 wt. % Ni, 0.75 wt. % Fe, 0.20 wt. % Si, 0.005 wt. % Be, and 0.20 wt. % Ti) rolled into sheet and annealed at 620°C for 24 hours showed much greater corrosion resistance to water than a composition without Ti or Be. (T.R.H.)

12741

IMPROVEMENTS IN OR RELATING TO THE HEAT TREATMENT OF ZIRCONIUM ALLOYS. Peter Charles Leslie Pfeil (to United Kingdom Atomic Energy Authority). British Patent 813,124. May 6, 1959.

A heat treatment to improve creep resistance of Zr alloys by decomposing the β phase is offered. Alloys of Zr with either 7.5 wt. % Mo, or 10 wt. % Nb, or 6.7 wt. % Sn, or 1.5 wt. % Al are homogenized in a vacuum furnace at 1100°C and, after cold-working, aged at 600°C 300 hours. Improvement in creep resistance is noted for the Mo and Nb alloys. (T.R.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

12742 CERN-59-8

European Organization for Nuclear Research, Geneva. FLOATING WIRE MEASUREMENTS ON THE SC MAGNET. A. Citron, F. J. M. Farley, E. G. Michaelis, and H. Øverås. Feb. 20, 1959. 43p.

The method of simulating trajectories of charged particles moving with uniform speed in a magnetic field by means of a wire under tension and carrying constant current has been described by Loeb. The conditions of stability are discussed, and it is shown that any particle trajectory can be represented by a stable wire if the wire is sufficiently light and if its two points of support are not separated by the image of one of them. The particular case of the magnetic field of the CERN 600-Mev synchrocyclotron is considered. (W.D.M.)

12743 CERN-59-12

European Organization for Nuclear Research, Geneva. COMPUTATION OF PARTICLE TRAJECTORIES IN THE CERN CYCLOTRON. F. J. M. Farley. Mar. 18, 1959. 18p.

Using the Ferranti Mercury Computer, particle trajectories in the CERN Cyclotron have been calculated including vertical focusing effects. The program, which is available for calculating orbits in any circularly symmetrical magnetic field, is briefly described. The trajectories of π mesons emitted from a target are analyzed to give the size and intensity of the final image formed outside the shielding wall in a typical extraction system. (auth)

12744 CERN-59-13

European Organization for Nuclear Research, Geneva. EMULSION WORK WITH THE CERN 25 GeV PROTON SYNCHROTRON. Report of Meeting held at CERN, Geneva, January 15-16, 1959. Mar. 1959. 89p.

Invitations were sent, within the CERN member states, to all laboratories known to be interested in using the photographic emulsion technique for high-energy nuclear research. A logical and complete account of the matters discussed at the meeting is given, rather than a full record of every remark made. Parts of the minutes from a previous unofficial meeting are included as are several complete papers. (W.D.M.)

12745 CERN-59-15

European Organization for Nuclear Research, Geneva. POWER FLOW MONITORS FOR THE LINAC H.F. SYSTEM. E. Zaccheroni. Apr. 7, 1959. 22p.

A general outline of the LINAC power flow monitor program is given. The design of reflectometers for the different stages of the H.F. chain is described and brief details are given of their practical construction. Calibration methods are discussed and curves for the different types of reflectometers are reported. (auth)

12746 NP-7386

Italy. Comitato Nazionale per le Ricerche Nucleari.
Frascati Laboratori.

THE γ -RAY BEAM OF THE 25 GeV PROTON SYNCHROTRON, ON THE EXPERIMENTAL USE OF THE γ -RAY'S RELATIVE POLARIZATION. Report No. G 27. G. Salvini and A. Turrin. Mar. 18, 1959. 16p.

The possibility of using the γ rays produced in π^0 decay in a 25-Bev proton synchrotron is considered. The energy and angular distribution of the photons are given, and the background due to the presence of neutrons is discussed. The fact that the twin gammas from π^0 decay are orthogonally polarized is suggested for use as a polarized source of photons. (W.D.M.)

12747 UCRL-8346(Rev.)

California. Univ., Berkeley. Lawrence Radiation Lab. ELECTRICAL SYSTEM OF THE BEVATRON RAPID BEAM EJECTOR (BEAM KICKER). Charles G. Dols. Mar. 1959. 12p. Contract W-7405-eng-48. \$3.30(ph), \$2.40(mf) OTS.

A rapid beam ejector was constructed to produce the brief pulses of particles required for optimum bubble chamber photographs. Energy stored in a capacitor bank was transferred to an air-core magnet surrounding the proton beam of the Bevatron. The protons were displaced from their normal orbit and strike a suitably located target; particles from this target can then emerge from the Bevatron. A capacitor bank of 120 μ f stores 13,500 joules at 15,000 volts. Two ignitrons in parallel connect the capacitor to the magnet. The magnet current rises to 52,000 amperes in 55 μ sec, at peak current a resistor is connected in parallel to damp the current decay. (auth)

12748

SUGGESTIONS FOR THE UTILIZATION OF THE ION BEAM MODULATION IN A CYCLOTRON FOR CONTROL PURPOSES. V. S. Panasyuk. J. Nuclear Energy 8, 92-5(1958) Nov.

It has been shown that an extracted beam from a cyclotron can be used to excite a high-frequency resonant circuit tuned to the frequency of rotation of the ions. When the signals pass through an alternating current amplifier, the constant component is naturally lost. It is shown that for many purposes this fact need not preclude the use of h-f amplifiers in the cyclotron control circuits. (W.D.M.)

12749

CONSIDERATIONS RELATING TO THE CHOICE OF THE DEE VOLTAGE IN A CYCLOTRON. Yu. A. Zavenyagin and N. D. Fedorov. J. Nuclear Energy 8, 95-9(1958) Nov.

Several methods of determining the required minimum dee voltage or alternatively of establishing the limiting ion energy for a given dee voltage have previously been proposed. In this instance the dependence of the magnetic field on the radius is chosen in a most general manner and the voltage necessary to accelerate the ions is determined for the initial ion phases within a given interval. (W.D.M.)

12750

MOMENTUM KICKS FOR PARTICLES CROSSING A GAP AT AN ANGLE. J. Van Bladel (Midwestern Universities Research Assn., Madison and Univ. of Wisconsin, Madison). Rev. Sci. Instr. 30, 285-8(1959) Apr.

Formulas are derived for the longitudinal and lateral momentum kicks to which a particle is subjected upon crossing an accelerating gap. The angle ϵ between the

particle's trajectory and the axis of the accelerator tube is assumed to be small, and terms of order higher than the first in ϵ are neglected in the formulas. (auth)

12751

22-Mev ELECTRON LINEAR ACCELERATOR. N. A. Austin (Varian Associates, Palo Alto, Calif.) and S. C. Fultz (Univ. of California, Livermore). Rev. Sci. Instr. 30, 284-9(1959) Apr.

A 22-Mev electron linear accelerator of the traveling-wave type with several unique features is described. The features include the combination of an r-f driven prebuncher cavity and a buncher of a new type in the first section of accelerator guide in order to obtain high-peak currents and minimum beam energy spread. A separately pulsed gun grid provides fast beam pulse rise time for use in neutron research. The accelerator and major electronics are housed in a single r-f shielded rigid cabinet, which facilitates portability for field operations. The beam energy is continuously variable from 2 to 27 Mev; peak current for a one- μ sec pulse is 380 ma; pulse rate is variable from 1 to 200 pulses per second; pulse length is variable from 0.2 to 2.4 μ sec; and pulse rise time is adjustable from 0.2 to 0.4 μ sec. (auth)

12752

USE OF SYNCHROTRON ORBIT-RADIATION IN X-RAY PHYSICS. L. G. Parratt (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 30, 297-9(1959) Apr.

Use of the intense x radiation emitted by centripetally accelerated electrons in the orbit of a high-energy synchrotron is discussed. Comparison is made of the prospective usefulness of this radiation in the range of wave lengths 0.1 to 20 \AA with the x rays obtainable from a conventional x-ray tube. In the design and use of synchrotrons to date, the very costly orbit radiation is a waste product. The proposed use of this radiation in x-ray physics would be essentially free. (A.C.)

12753

VACUUM SYSTEM FOR A THIRTY BILLION ELECTRON VOLT PARTICLE ACCELERATOR. C. L. Gould (Brookhaven National Lab., Upton, N. Y.). Vacuum 9, 63-8(1959) Mar.

A vacuum system is being developed for a thirty billion electron volt particle accelerator. The vacuum chamber is a torus one-half mile in circumference with a cross section of 3 in. by 7 in. Approximately fifty getter-ion type pumps will be used on the ring to give the required pressure of 2×10^{-6} mm Hg. A linear accelerator yielding fifty million electron volts protons will be used as the injector. The vacuum chamber of this accelerator is 110 ft long and 3 ft in diameter. It will be evacuated to 1×10^{-6} mm Hg by eleven getter-ion pumps. The choice of getter-ion pumps has permitted a departure from conventional vacuum system design and operation. Details of some new concepts of initial evacuation, steady state operation, and simplicity of control of a system of this nature will be given. (auth)

12754

CALCULATION OF THE ION OPTICAL PROPERTIES OF INHOMOGENEOUS MAGNETIC SECTOR FIELDS, INCLUDING THE SECOND ORDER ABERRATIONS IN THE MEDIAN PLANE. H. A. Tasman and A. J. H. Boerboom (Laboratorium voor Massaspectrografie, Amsterdam). Z. Naturforsch. 14a, 121-9(1959) Feb.

Investigation is made of the ion optical properties of inhomogeneous magnetic sector fields. In first order

approximation the field is assumed to vary proportional to r^{-n} ($0 \leq n < 1$); the term in the magnetic field expansion which determines the second order aberrations is chosen independent of n , which makes possible the elimination of the second order angular aberration. From the Euler-Lagrange equations the second order approximation of the ion trajectories in the median plane and the first order approximation outside the median plane are derived for the case of normal incidence and exit of the central path in the sector field. An equation is presented giving the shape of the pole faces required to produce the desired field. The influence of stray fields is neglected. The object and image distances are derived, as well as the mass dispersion, the angular, lateral, and axial magnification, the resolving power, and the inclination of the plane of focus of the mass spectrum. The maximum transmitted angle in the z -direction is calculated. The resolving power proves to be proportional to $(1-n)^{-1}$, whereas, the length of the central path is proportional to $(1-n)^{-1/2}$. An actual example is given of a 180° sector field with $n = 0.91$, where the mass resolving power is increased by a factor of 11 as compared with a homogeneous sector field of the same radius and slit widths. (auth)

12755

CALCULATION OF A DOUBLE-FOCUSING, STIGMATIC IMAGE-FORMING MASS SPECTROGRAPH. H. Ewald, H. Liebl, and G. Sauermann (Technischen Hochschule, Munich). *Z. Naturforsch.* **14a**, 129-37 (1959) Feb. (In German)

The calculation data for a stigmatic image-forming, double-focusing mass spectrograph equipped with toroidal condenser are summarized. In this apparatus the radial image distortion f_{33} , caused by the relatively large axial aperture angle, was corrected by a corresponding calculated cylinder curvature of the exit face of the toroidal condenser. (tr-auth)

12756

CONSTRUCTION AND TESTING OF A DOUBLE-FOCUSING, STIGMATIC IMAGE-FORMING MASS SPECTROGRAPH. G. Sauermann and H. Ewald (Technischen Hochschule, Munich). *Z. Naturforsch.* **14a**, 137-41 (1959) Feb. (In German)

A double-focusing mass spectrograph was built which is equipped with a toroidal condenser in place of the usual cylinder condenser in order to obtain stigmatic image formation of the slit point at the point of the mass line in addition to the double focusing in the radial direction. The correction of the radial image error f_{33} proportional to the quadrate of the axial slit angle was corrected by an additional cylinder curvature of the exit face of the toroidal condenser. Reproducible sharp and very intense mass lines could therefore be obtained. The resolution obtained was approximately 25,000 in a diffraction radius of $a_e = 120$ mm in the electrical field. Because of the shortening of the mass lines by the stigmatic image formation, the exposure time for the most intensive lines of the spectra was less than 0.1 sec. (tr-auth)

12757

THE IMAGE DISTORTION CORRECTION FOR DOUBLE FOCUSING MASS SPECTROGRAPHS. H. Ewald (Technischen Hochschule, Munich). *Z. Naturforsch.* **14a**, 198-9 (1959) Feb. (In German)

The image distortion in a stigmatic double focusing mass spectrograph in which a toroidal condenser was used in place of the usual cylindrical condensers was

calculated. The conditions for $f_{33} = 0$ were determined. (J.S.R.)

12758

MASS SPECTROGRAPHS WITH DOUBLE FOCUSING OF THE SECOND ORDER. H. Liebl and H. Ewald (Technischen Hochschule, Munich). *Z. Naturforsch.* **14a**, 199-200 (1959) Feb. (In German)

The conditions for double focusing of the second order were numerically calculated, and the results are tabulated. (J.S.R.)

PHYSICS AND MATHEMATICS

General

12759 56-RL-1611

General Electric Co. Research Lab., Schenectady, N. Y.

STRESS ANALYSIS OF PERFORATED PLATES.

G. Horvay. Sept. 1956. 16p.

Formulas and curves are presented for design and strength evaluation of perforated plates. (auth)

12760 AE-4

Aktiebolaget Atomenergi, Stockholm.

A SLOWING-DOWN PROBLEM. I. Carlvik and

B. Pershagen. Oct. 1957. Revised June 1958. 28p.

An infinitely long cylinder surrounded by an infinite moderator is considered. Both media are noncapturing, and the cylinder emits neutrons of zero age with a constant source density. The slowing-down density is calculated for the case when the slowing-down power of the cylinder medium is very small, and for the case when the cylinder medium is identical with the moderator. (W.D.M.)

12761 AE-15

Aktiebolaget Atomenergi, Stockholm.

ON THE SPHERICAL HARMONIC EXPANSION OF THE NEUTRON ANGULAR DISTRIBUTION FUNCTION.

Sven Depken. Oct. 1958. 55p.

The neutron (one-velocity) angular distribution function is expanded in terms of spherical harmonic tensors. The solution to the equations of the moments is given explicitly, and the result is applied to the plane, spherical, and cylinder symmetrical cases. (auth)

12762 AERE-C/M-58

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE GROWTH, DECAY AND β ABSORPTION CHARACTERISTICS OF THE LONG-LIVED FISSION PRODUCTS.

I. TABLES OF FISSION PRODUCT GROWTH AND DECAY. G. B. Cook and F. Morgan. Feb. 1950. 10p.

The growth, decay and β absorption characteristics of the long-lived fission products are presented graphically. Values are presented throughout as relative disintegration activities. The product of fissions/sec times the factor (resulting from multiplying the fission yield by the fraction of saturation) gives the activity in disintegrations/sec. (J.R.D.)

12763 AERE-CE/R-757

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DIRECT CURRENT PUMPING OF LIQUID METALS.

D. A. Watt. Sept. 28, 1951. Decl. Apr. 30, 1959. 58p.

The general theory of d-c electromagnetic pump design is given together with a detailed design study for a

pump to circulate sodium-potassium alloy at 250°C with a pressure rise of $3\frac{1}{2}$ atm. and a flow rate $13\frac{1}{2}$ liters/sec. All types of ohmic loss are detailed including that due to end current flow with baffles. Several possible designs with efficiencies of approximately 50% are indicated in the summaries of selected instances, covering a range of pump flow speeds from 10 to 30 ft./sec. These designs require a d-c supply of 7,000 to 13,000 amps at 1.1 to 0.6 volts. Hydrodynamic friction losses with zero magnetic field are tabulated. The extent to which "armature reaction" influences output and ohmic loss in an ideal pump with no compensating return current paths is also detailed. A note on the use of permanent magnet materials is appended. (auth)

12764 AERE-NP/M-96

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

NEUTRON REFLECTIVITIES OF SOME BERYLLIUM CRYSTAL PLANES. Maureen R. McQuhae and N. J. Pattenden. Feb. 1959. 10p.

A knowledge of the absolute reflectivity as a function of neutron energy for the monochromating crystal of a neutron crystal spectrometer is necessary to estimate the intensity of the monochromatic beam and to measure the neutron spectrum at the source of the beam in the reactor. Beryllium is a commonly used monochromator, and the three sets of planes (10 $\bar{1}$ 1), (12 $\bar{3}$ 1), and (13 $\bar{4}$ 1) provide a convenient range of resolutions together with acceptable counting rates and good discrimination against higher orders. The absolute reflectivities of these planes as a function of crystal thickness and neutron glancing angle for the first- and second-order reflections are calculated. (auth)

12765 AERE-RP/R-1825

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE FINE STRUCTURE THERMAL NEUTRON DISTRIBUTION IN NATURAL URANIUM-GRAPHITE LATTICES. J. M. Lloyd and J. E. C. Mills. Apr. 1956. 19p. \$0.49(BIS).

A first series of measurements of the thermal neutron distribution between fuel elements in various natural uranium-graphite lattices, using manganese wire as a detector, is reported. This distribution is required in order to calculate the thermal utilization in the lattice. The results are expressed in the form of ratio of maximum to average flux in the uranium, the ratio of maximum to minimum flux across any annuli or air channel, and the average to minimum in the graphite. Indium cadmium ratio measurements were also made and are compared with the above ratios. (auth)

12766 AERE-RP/R-1826

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE FINE STRUCTURE THERMAL NEUTRON DISTRIBUTIONS IN URANIUM-NATURAL WATER LATTICES—EXPERIMENTAL RESULTS. J. E. C. Mills and C. G. Campbell. Apr. 25, 1956. Changed from OFFICIAL USE ONLY Apr. 30, 1959. 16p.

A series of measurements of the thermal neutron distribution across a lattice cell in various uranium-natural water lattices is reported. In some cases the fuel is slightly enriched in U²³⁵ content. Manganese wire detectors were used. The results are expressed

in terms of the ratio of the maximum to average flux in the fuel (G), the ratio of the maximum to the minimum flux across the fuel sheath (R), and the average to minimum flux in the moderator (S). These parameters are required for the assessment of thermal utilization in the lattices. (auth)

12767 AERE-T/M-39

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TABLE OF $F(x) = e^{-x^2} \int_0^x e^{t^2} dt$. P. M. Hanney and J. Howlett. [1949?]. 4p.

A table of values of the function $F(x) = \exp(-x^2) \int_0^x \exp(t^2) dt$ correct to 1 unit in the fifth decimal place over the range 0.0(0.1) to 10 is presented. (J.R.D.)

12768 AERE-T/R-2787

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STABILITY OF TWISTED MAGNETIC FIELDS IN A FLUID WITH FINITE TRANSPORT PROCESSES AND MASS MOTIONS. 1. GENERAL CONSIDERATIONS. R. J. Tayler. Jan. 1959. 32p.

The investigation of the stability of static plasma equilibrium configurations, when transport processes are neglected, can be reduced to the solution of a second order linear differential equation and a transcendental dispersion relation. Alternatively a variational procedure has been formulated. If the effects of finite electrical conductivity, viscosity, and thermal conductivity are introduced, a twelfth order (or in the case of an incompressible fluid a tenth order) differential equation has to be solved. It is shown that, for an incompressible fluid with constant isotropic transport coefficients, there is one simple configuration in which the tenth order equation can be solved completely in terms of Bessel functions. In this configuration a cylindrical column of fluid carries a uniform axial magnetic field and a uniform axial current and its mass motion consists of a uniform motion along the axis and a uniform angular velocity about the axis. The solution of the dispersion relation is still a serious problem; indication is given of a way in which this solution might be attempted. (auth)

12769 ERDL-1573-TR

Army Engineer Research and Development Labs., Fort Belvoir, Va.

THEORETICAL BACKGROUND AND DERIVATION OF SELECTED EQUATIONS FROM THE REPORT STUDY OF BLAST EFFECTS IN SOIL. O. Kirk Ehlers and Allen F. Grum. Mar. 27, 1959. 36p.

An amplification and clarification of the report Study of Blast Effects in Soil by M. A. Chaszeyka and F. B. Porzel of the Armour Research Foundation is presented. The basic thermodynamic relationships that are essential to the understanding of the Armour Report are given, and the more complex equations of the Armour Report are derived. (auth)

12770 HW-59126

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1958. Jan. 20, 1959. 124p. Contract W-31-109-Eng-52. \$2.75(OTS).

The experimental program to study the neutron-induced fission in low-energy resonances of nuclides

with well defined fast neutron thresholds for fission in Pu^{240} , Np^{237} , and Am^{241} is summarized. The infinite multiplication factor and thermal utilization factor were measured for U_2O -moderated UO_2 lattices. The 19 rod clusters on a nine-inch triangular pitch were either UO_2 or 16 UO_2 and 3 Pu-Al rods. Flux traverse data are given. The material bucklings of fuel elements composed of 7-rod clusters of 0.5-inch-diameter natural uranium rods were measured as a function of lattice spacing in graphite. The measurements were made in small exponential assemblies having cross sections of 4×4 feet or slightly larger. Radial neutron activation traverses, using Cu , $\text{U}^{235}\text{-Al}$, and $\text{Pu}^{239}\text{-Al}$ detectors, were made in solid cylindrical fuel elements whose compositions simulated highly exposed natural uranium. An experimental investigation of the spatial dependence of the thermal neutron reaction rate in the vicinity of a temperature discontinuity is in progress. The data taken in moderators with temperatures ranging from 108 to 666°K; a description of the experimental procedures, and a statement of the present status of this work are presented. The program of critical mass measurements with 3.063% enriched uranium rods in light water was continued. Critical approach measurements of the 0.600-inch diameter rods are reported. Reactivity parameters were calculated for bare fuel elements of 1.027% U^{235} enrichment in light water lattices. A formal analytical solution of the problem of thermal neutron flux in a nonabsorbing heavy gas medium with a temperature discontinuity was previously obtained in the form of an infinite series. The convergence and numerical evaluation of the analytical solution and the utility of calculated reaction rates are discussed. Two approximation schemes are described. Pertinent formulas and numerical comparisons of the various versions of flux and $1/v$ reaction rate for a temperature ratio of 2:1 are presented. Data from recent Hanford Test Pile experiments were employed to predict the effect of various changes in fuel rod cladding on the reactivity of a dry, graphite moderated, infinite lattice, fueled with natural uranium. A general method is developed for attacking problems of variational analysis of multi-dimensional systems through the systematic replacement of a complicated theory involving many independent variables by a simpler theory, involving equations in fewer independent variables. (For preceding period see HW-57861.) (W.D.M.)

12771 IGR-TM/CA-0143

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

PERMEABILITY OF POROUS SOLIDS: UNITS AND DEFINITIONS. M. H. Dodson. Sept. 2, 1958. 8p.

Confusion is caused by the use of the darcy to denote permeability to gases of materials with fine pores. The main facts concerning flow of gases through porous materials are summarized, and the use of c.g.s. units is advocated. (auth)

12772 KAPL-M-EJ-8

Knolls Atomic Power Lab., Schenectady, N. Y. STRUCTURAL EVALUATION OF S3G/S4G CORE 1 TUBE STRUCTURES. E. B. Johansson. Apr. 9, 1959. 45p. Contract W-31-109-Eng-52. \$7.80 (ph), \$3.30 (mf) OTS.

The structural evaluation of the tube structures for the Submarine Advanced Reactor Core 1 is presented. Stresses due to pressure, thermal, and mechanical

shock loadings are calculated. The effect of pressure surges due to check valve slams, and pressure oscillations in the primary coolant system is also evaluated. Test results pertinent to the structural evaluation are presented. The life of the tube structures under cyclic hydraulic loading is one of the major considerations. The analytical methods and some of the test results are applicable to similar configurations. It is concluded that the tube structure is adequate for the intended service. (auth)

12773 KAPL-M-S3G-RES-67

Knolls Atomic Power Lab., Schenectady, N. Y. PST: AN IBM-704 EDPM PROGRAM FOR NODALIZING POWER DISTRIBUTIONS OF A REACTOR CORE FOR FURTHER USE IN THERMAL DIGITAL COMPUTER INVESTIGATIONS. J. W. Millard. Apr. 8, 1959. 20p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

In order to use many of the thermal design codes, it is necessary to nodalize the continuous power distributions. A code, PST, intended for this purpose is described. PST is primarily useful where either volume normalized or power fraction data is required. Both are obtained from PST. PST is an outgrowth of a previous code, PAS. The changes from PAS allow determination of the nodalized power fraction and the unity normalized water rise integral. (auth)

12774 KAPL-M-SWK-8

Knolls Atomic Power Lab., Schenectady, N. Y. A COMPUTER EXPERIMENT ON METHODS OF CONVERGENCE OF REM AND CURE. S. W. Kitchen and E. L. Morgan. Apr. 10, 1959. 20p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

The complexity of problems being solved by use of digital computers has become so great that it is frequently necessary to determine not only the solution but the relative merits of different methods of arriving at the solution by empirical testing on the computer rather than by mathematical analysis. This report gives the results of such tests on convergence of REM, a two-dimensional three group, neutron diffusion code. Cell calculations were adequately converged on the eigenvalue in minimum time using one flux double sweep per group per source iteration using no flux extrapolation. However, the calculated local power peaking was pessimistic by up to 10%. Adequate convergence of both eigenvalue and local power peaking in minimum time was obtained by permitting the number of flux sweeps to increase from one in the first source iteration and by allowing the flux extrapolation parameter to increase on successive sweeps from 10^{-5} by factors of ten. Improvement of up to 10% in local peaking factors required an increase of 50% in IBM 704 time. (auth)

12775 LA-2278

Los Alamos Scientific Lab., N. Mex. PUBCO-I, AN IBM 704 CODE FOR COMPUTING THE IDEAL THERMODYNAMIC FUNCTIONS OF A POLY-ATOMIC GAS MOLECULE. Lawrence R. Sitney. Nov. 1958. 52p. Contract W-7405-eng-36. \$1.50(OTS).

The PUBCO-I code computes the ideal thermodynamic functions of polyatomic molecules by either the rigid rotator-harmonic oscillator (RRHO) or the nonrigid rotator-anharmonic oscillator (NRRAO) method. The type of computation performed by the IBM 704 is at the option of the operator and will depend, in general, upon the availability of sufficient spectroscopic data to carry out the NRRAO calculations. The equations used to describe the thermodynamic functions in the two treat-

ments are discussed. A general description of the code is presented and the complete IBM listing for the code is given. Sample computations of the ideal thermodynamic functions of HCN are given for both the RRHO molecule and the NRRHO molecule. (auth)

12776 LAMS-2201

Los Alamos Scientific Lab., N. Mex.

THE S_N METHOD AND THE SNG CODE. Bengt G. Carlson. Jan. 26, 1958. 65p. Contract W-7405-eng-36. \$2.00(OTS).

A brief description of S_N -type difference methods for solving the neutron transport equation is given. A particular case in one dimension and the corresponding code for the 704 calculator are developed in detail. (auth)

12777 NAA-SR-Memo-2025

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EFFECT OF A THERMAL GRADIENT ON THE HYDROGEN DISTRIBUTION IN A METAL. APPLICATION TO THE SODIUM REACTOR EXPERIMENT. G. G. Libowitz. Aug. 5, 1957. 19p. \$3.30(ph), \$2.40(mf) OTS.

The effect of hydrogen on the zirconium cans which contain the graphite moderator in the SRE was investigated. Since these Zr cans are under a thermal gradient, a method of obtaining the hydrogen concentration distribution becomes necessary. The relation between pressure, temperature, and hydrogen content of hydrogen in metals has been derived from statistical mechanical considerations. Figures are given on the distribution of hydrogen in Zr in a thermal gradient from 500 to 960°F. (W.L.H.)

12778 NP-7474

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 32. Apr. 15, 1959. 101p. Contract Nonr-1841(34).

Completed work is presented on Zeeman splittings of paramagnetic atoms in crystalline fields and Hartree-Fock calculations in the iron group. Calculations on working out crystalline field theory in detail for a Ni^{2+} ion in a crystal of MgO are reported. Reports are given on magnetic interactions in a linear chain of atoms and on the polaron. The use of approximate potentials in energy-band calculations is discussed. The computation program work is summarized. A study of the possibility of combining Gaussian and exponential functions for molecular calculations is continuing. (For preceding period see NP-7284.) (W.D.M.)

12779 NP-7520

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period January-March 1959. Apr. 1, 1959. 25p.

Angular correlations for the $C^{13}(\text{He}^3, \alpha\gamma)$, $B^{10}(\text{He}^3, \gamma)$, and $B^{11}(\text{He}^3, \alpha\gamma)$ reactions were investigated. Punched-tape readout for a 256-channel pulse-height analyzer is discussed. Experimental results from a study of the $B^{11}(\text{He}^3, p)$ and (He^3, d) are given and discussed. A brief report on the He flux in cosmic radiation at geomagnetic latitude 3°N is presented. Monte Carlo calculation of gamma-ray slab penetration is reported. (For preceding period see NP-7289.) (T.R.H.)

12780 NYO-2459

Princeton Univ., N. J. Palmer Physical Lab.

A MEASUREMENT OF THE G-VALUE OF THE ELECTRON IN THE GROUND STATE OF THE HYDROGEN

ATOM (thesis). Edward B. D. Lambe. Mar. 1959. 110p. Contract AT(30-1)-937. \$18.30(ph), \$6.00(mf) OTS.

A new measurement of the ratio g_1/g_p ($g_1 = g$ -value of the electron in the ground state of the hydrogen atom; $g_p = g$ -value of the proton as observed in a spherical sample of distilled water) was made. A microwave absorption technique in a hydrogen atom gas with a molecular hydrogen gas buffer to reduce Doppler broadening was used. Special attention was devoted to the factors which influence the width and strength of the absorption line. In particular, the necessity for an impurity gas additional to the molecular hydrogen to effect thermal relaxation of the electron spins in the external magnetic field was established. The value of g_1/g_p is found to be $658,2159088 \pm 0.0000436$. This value is the weighted average of measurements on both the η_1 and the η_2 transitions in atomic hydrogen. (auth)

12781 ORNL-2694

Oak Ridge National Lab., Tenn.

A PROGRAM FOR THE CALCULATION OF MAXWELL-BOLTZMANN AVERAGED CROSS SECTIONS ON THE IBM-704 COMPUTER. C. W. Nestor. May 18, 1959. 10p. Contract W-7405-eng-26. \$0.50(OTS).

A 704 program was written and checked for the calculation of cross sections averaged over a Maxwell-Boltzmann flux. Up to 200 energy values and corresponding point cross sections may be used to compute average cross sections at as many values of thermal energy (kT) as may be specified. The upper limit of the integration may be either a multiple of the thermal energy or the last energy for which cross sections are available. (auth)

12782 RISÖ-4

Denmark. Atomenergikommisionen. Forsøgsinstitut, Risø.

ENERGY EXCHANGE BY COULOMB ENCOUNTERS FOR MAXWELLIAN ION MIXTURES IN THE PLASMA STATE. Carl F. Wandel. Jan. 1959. 20p.

An elementary derivation is given of the energy exchange rates by Coulomb encounters for groups of non-relativistic charged particles with different temperatures under the assumption that each group has a Maxwellian velocity distribution. The product of particle density and relaxation time for energy exchange depends essentially only on the kind of particles considered and their temperatures. Graphical presentation is given of this product for electrons, deuterium and He^4 ions in a temperature range of interest for thermonuclear reactions. Representative values for the relaxation times are at a temperature of, $kT = 10$ kev and a particle density, $n = 10^{13} \text{ cm}^{-3}$: 3.2 msec by electron-electron collisions, 4.2 sec by electron-deuteron collisions and 200 msec by deuteron-deuteron collisions. In a supplement a derivation is given of the expressions for the energy exchange between a monoenergetic and a Maxwellian particle group and between two isotropic monoenergetic groups. (auth)

12783 RISÖ-8

Denmark. Atomenergikommisionen. Forsøgsinstitut, Risø.

PRELIMINARY REPORT ON THE METEOROLOGICAL MEASUREMENTS AT RISÖ. H. Bjerrum Møller and K. Jensen. Feb. 1959. 47p.

A brief outline is given of the atmospheric diffusion theory and a derivation of the formulas used in atmospheric diffusion problems. A description of the mete-

orological station, tower and equipment (illustrated with diagrams and photographs), and an account of the daily handling of the direct records are also given. Statistics are presented based on the results obtained during the short period in which the meteorological station has been in operation (August 1957 to March 1958). (auth)

12784 SC-4272(M)

Sandia Corp., Albuquerque, N. Mex.

HYPRMU—A GENERAL UTILITY PROGRAM FOR THE IBM 705 MODEL II SYSTEM. L. E. West. Apr. 10, 1959. 70p. Contract [AT(29-1)-789]. \$10.80(ph), \$3.90(mf) OTS.

HYPRMU is an interpretive program used in conjunction with a special coding system to search for a desired record or set of records; extract information from records; rearrange the format of records, edit, add new information, delete unwanted information, find matched pairs of records existing in separate files and develop output records from desired portions of matched pairs, detect and write mismatched records, and several other operations that involve the content and arrangement of information within records. (auth)

12785 SCTM-64-59(51)

Sandia Corp., Albuquerque, N. Mex.

AFT BODY AND FIN LOADS (IN THE PRESENCE OF A SPOILER BAND) ON A HIGH-FINENESS-RATIO BODY AND BODY-FIN COMBINATION THROUGH THE MACH RANGE FROM 0.3 TO 1.2 AT ANGLES OF ATTACK FROM 0 TO 40 DEGREES. Roger E. Tate. Apr. 9, 1959. 225p. Contract [AT(29-1)-789]. \$34.80(ph), \$9.90(mf) OTS.

A wind-tunnel pressure test was run on a high-fineness-ratio body and body-fin combination with a spoiler band where pressures were measured on the body and horizontal fins at angles of attack from 0 to 40 degrees over the Mach range from 0.3 to 1.2. Body and fin load distributions were calculated from the measured pressures. These distributions were then integrated to obtain body and fin normal-force loads and fin centers of pressure. (auth)

12786 SCTM-113-59(51)

Sandia Corp., Albuquerque, N. Mex.

A WIND TUNNEL INVESTIGATION OF THE DRAG CHARACTERISTICS OF VARIOUS DISC CONFIGURATIONS. (PROGRAM III-34). T. R. Holland. Apr. 1959. 57p. \$10.80(ph), \$3.90(mf) OTS.

A wind tunnel force test was conducted in September 1958 at the Sandia Corporation 12×12 in. transonic wind tunnel. The drag characteristics of 18 disc configurations were determined. Drag coefficients were obtained over the Mach range from 0.5 to 1.33 at zero degrees angle of attack. The Reynolds number varied from 0.45×10^6 to 1.99×10^6 , based on maximum model diameter. (auth)

12787 UCRL-5275-T

California, Univ., Livermore. Lawrence Radiation Lab.

MONTE CARLO METHODS FOR EQUILIBRIUM SOLUTIONS IN NEUTRON MULTIPLICATION. E. L. Kaplan. Dec. 1958. 104p. Contract W-7405-eng-48. \$2.50 (OTS).

Possible improvements in the Monte Carlo estimation of the multiplication rate α are explored analytically. Some of the results apply to neutron problems in general. The study is intended as groundwork for the design of computing codes, but most questions of computational ef-

iciency and coding are not taken up. The principal aims are to hasten the approach to the equilibrium distribution of neutrons, and to increase the statistical reliability of the results. The most important techniques are the use of the largest eigenvalue and the corresponding eigenvector of a matrix describing the flow of neutrons, the transformation of collision parameters to eliminate discontinuities in the particle weights at collisions, and methods for controlling the number and/or the relative weights of the particles. Estimation formulas and importance sampling are discussed. The elapsed time is used as the underlying variable, rather than the number of collisions as in methods analogous to the iteration of an integral equation. (auth)

12788 UCRL-5467

California, Univ., Livermore. Lawrence Radiation Lab.

NONLINEAR DIFFUSION OF STRONG MAGNETIC FIELDS INTO A CONDUCTING HALF-SPACE. Ray E. Kidder. Jan. 1959. 13p. Contract W-7405-eng-48. \$0.50(OTS).

In the treatment of the nonlinear problem the effects of thermal conduction are neglected. These effects will generally be small except in the immediate vicinity of the conductor. Some solutions of the linear problem including thermal conduction are given from which it is possible to estimate the effect of thermal conduction in the nonlinear case. (A.C.)

12789 WAPD-V(FBE)-115

Vitro Engineering Co., New York.

REPORT ON COMPLETED WORK ON TRANSIENT BOILING. S. K. Hellman, S. Kaminsky, and R. W. Kupp [Apr. 9, 1959]. 100p. For Westinghouse [Electric Corp. Bettis Atomic Power Div.]. Subcontract 73-(14-1025). \$15.30(ph), \$5.40(mf) OTS.

The results of an effort toward the ultimate formulation of a function which can be used to predict void volumes during runaway of a pressurized water reactor are presented. The emphasis is on bubble formation and dynamic aspects of the bubble void function relating the built-in parameters such as wall temperatures, flow, and bulk temperature to the void. A literature search was conducted, and the information gained was used to resolve some of the numerous phenomena associated with transient void formations in nucleate boiling. Mathematical analyses are included as well as numerous graphic presentations. 44 references. (J.R.D.)

12790 AEC-tr-3648

FLOW PATTERN AND HEAT CONDUCTION IN FLUIDIZED BEDS. F. Fetting and E. Wicke. Translated from *Dechema Monograph* 24, 146-69(1955). 28p. \$4.80(ph), \$2.70(mf) JCL or LC.

The measured heat coefficient a as a function of the rate of flow u has been shown for glass beads in air as well as for activated charcoal in air and carbon dioxide. (W.L.H.)

12791 CEA-tr-A-263

MESURES SANS ÉLECTRODES DE LA CONDUCTIBILITÉ ÉLECTRIQUE PAR LA MÉTHODE DU CHAMP TOURNANT. (Electrodeless Measurements of Electric Conductivity by the Rotating Field Method.) A. Roll, H. Flegler, and H. Motz. Translated into French from Z. Metallk. 47, 708-13(1956). 28p.

An apparatus for the electrodeless measurement of the electrical resistivity of metals at temperatures up to 1250°C is described. In the method used, the cylindrical sample undergoes torsion in a variable magnetic

field. The magnitude of the field induced depends not only on the dimensions of the sample but depends also linearly on the conductivity. The measurements can be made in vacuum or in a protective atmosphere. The precision is of the order of $\sim 1\%$ for absolute measurements of the specific electrical resistivity and $\sim 0.5\%$ for the temperature coefficients. The resistivity of copper, aluminum, lead, zinc, bismuth, and thallium was determined as a function of the temperature up to the fusion point. The data obtained were compared with previous results. (tr-auth)

12792 CEA-tr-A-560

MONOGRAMMES POUR LA LOI D'ABSORPTION DES RAYONS RADIOACTIFS. (Monograms for the Absorption Law of Radioactive Radiations.) A. Stammberger. Translated into French from Technik (Berlin) **12**, 701-3 (1957). 7p.

Monograms relating the radiation intensity before passage through a wall, the wall thickness, radiation intensity after passage through the wall, and the coefficient of linear attenuation are presented. (J.S.R.)

12793 IGRL-T/CA-92

DESIGN OF SPINNING DISCS. H. Hausenblas. Translated by B. Rigby (U.K.A.E.A., Risley) from Konstruktion **8**, 18-22(1956). 12p.

The known methods of designing spinning disks are compared, and the Keller-Salzmann method is described. An example is used to illustrate the method, and data are presented. (auth)

12794 NP-tr-233

ASYMPTOTIC METHODS IN THE THEORY OF NON-LINEAR OSCILLATIONS. (Asimptoticheskiye Metody V Teorii Nelineynykh Kolebaniy.) N. N. Bogolyubov and Yu. A. Mitropol'skii (Mitropol'skiy). Translated from State Publishing House for Technical-Theoretical Literature, Moscow. 1955. 447p.

The theory of nonlinear oscillations is considered. Natural oscillations in quasi-linear systems with one degree of freedom are discussed as well as methods of the mean, by the use of which systems with many degrees of freedom may be considered. In addition, basic information on the method of the phase plane is given, and free oscillations in relaxation-type systems are discussed. A study of oscillatory systems under the influence of external periodic forces is presented. Finally, justifications of asymptotic methods are discussed, and a series of theorems on the existence and stability of periodic and quasi-periodic solutions is established. (J.R.D.)

12795

THE ENERGY LOSS OF POSITIVE IONS IN HYDROGEN. Eugen Badarau and Mircea Hagiescu-Miriste (C. J. Parhon Univ., Bucharest). Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **2**, 71-9(1951) Jan.-June.

The velocity of positive ions accelerated across a space by an electric field was measured in the direction of the electric field. The positive ions are formed by electrons with sufficient energy to ionize hydrogen. The results are graphed and show that the hydrogen ions retain a large fraction of their kinetic energy in contradiction to the predictions of the gas kinetic theory. The energy loss of the ions is explained partially by the phenomenon of electron transfer. (tr-auth)

12796

THE POSSIBILITY OF APPLYING THE CLASSICAL THEORY OF ELECTRICITY AND THE GENERAL RELATIVITY THEORY TO THE STUDY OF ELEMEN-

TARY REACTIONS. I. CONSIDERATION ON THE NATURE OF ATOMIC FORCES. Teofil T. Vescan. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **2**, 295-8(1951) July-Dec. (In Rumanian)

The possibility of applying the classical electrostatic theory and the general relativity theory to the study of atomic forces is shown. (tr-auth)

12797

THE POSSIBILITY OF APPLYING THE CLASSICAL THEORY OF ELECTRICITY AND THE GENERAL RELATIVITY THEORY TO THE STUDY OF ELEMENTARY REACTIONS. II. Teofil T. Vescan. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **2**, 299-311(1951) July-Dec. (In Rumanian)

In the electrostatic theory of intramolecular and intermolecular forces, the Coulomb formula of point action is always applied. The possibility of explaining the non-Coulomb potential by the action of a charged sphere on a point or spherical charge, where the polarization of the charge occurs in a more exact fashion than in previous considerations of this reaction, is shown. The explanation of the Born potentials, the more exact calculation of the dissociation potentials, and the use of formulas of the non-Coulomb reactions, not only in the classical theory, but also in Schrodinger mechanics are predicted. (tr-auth)

12798

THE CALCULATION OF THE ENERGY LEVELS OF HEAVY ATOMS WITH THE AID OF THE THOMAS AND FERMI MODEL. V. Sergiescu. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **3**, 63-70(1952). (In Rumanian)

The energy levels of heavy nuclei were calculated within the framework of the classical quantum theory by the application of the Titeica method. The integral of the radial phase was calculated graphically using the Thomas-Fermi statistical potential. In this integral the energy W has the role of a parameter which is obtained as a function of the quantum numbers n and l and the atomic number Z . The calculations were made for the elements with Z from 81 to 100. The results are exact from a qualitative viewpoint, however the quantitative error is from 10 to 600%. The interest of the calculation lies in the information which can be obtained on the structure of the electronic configurations. All the well-known anomalies of the periodic table are found. For the transuranic elements a configuration of the "transition element" type resulted. However, the configuration of the "actinide" type, recommended by Starke, is adopted following a discussion of the relative importance of the calculation errors. (tr-auth)

12799

NEW INVESTIGATIONS ON THE PRESENCE OF NEGATIVE DEUTERIUM IONS IN HYDROGEN. Theodor Ionescu and Vasile P. Mihu. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **3**, 71-89(1952). (In Rumanian)

The energy absorption of negative hydrogen ions produced in the Faraday region at the interior of a tube crossed by a continuous current is studied. The frequencies studied are between 400 and 1940 cm. It is shown experimentally that there are characteristic frequencies of negative hydrogen ions. These frequencies are shown either by the energy absorption of ionized gas by the resonator, energy transfer of ionized gas by the resonator, or by energy transfer of the latter to the ionized gas. The curves obtained give

a number of characteristic frequencies higher than that indicated by calculation for negative hydrogen ions. These frequencies are attributed to negative deuterium ions. The energy absorption in a constant magnetic field parallel to the axis of the tube and to the resonator coil was also studied. The characteristic frequencies were not affected by the magnetic field. The probability of the formation of negative deuterium ions in ionized gas was discussed, and it was concluded that the large number of negative deuterium ions can be explained by thermodynamic considerations. The hypotheses which can justify the formation of negative D_2 ions in place of HD ions are discussed. (tr-auth)

12800

A RULE CONCERNING THE VARIATION OF THE ATOMIC AND IONIC RADII AND OF THE IONIZATION POTENTIALS. Dumitru D. Procopiu. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **4**, 27-68(1953) Jan.-June. (In Rumanian)

A rule, based on the results obtained from a comparison of the atomic radius and volume for 75 elements, the ionic radiation for 52 ions, and the ionization potentials for 71 elements, is presented. The rule is applicable to elements when they are arranged by principal or secondary groups in the periodic system and when they are found in analogous conditions. It is expressed by the general formula $r_z = (K \times f(n)/\sqrt{Z})$, where r_z is the radius of the atom or ion with atomic number Z and $f(n)$ is a function of the principal quantum number of the peripheral electron shell of the atom or the ion considered. $f(n)$ takes in almost all cases the value of a perfect square. K is a constant dimension whose value depends on conditions of the system considered, conditions characteristic of the group. As a function of the state of the element—free atom, atoms in crystalline lattices, ionized atom—almost linear function can be established for some series of principal or secondary groups and relations of a very general order can be obtained. (tr-auth)

12801

AN ELECTRIC ROCKET WITH NUCLEAR ENERGY AS A COMMUNICATION SHIP BETWEEN CIRCULAR ORBITS. I. Shechtman. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **7**, 117-44(1956) Jan.-Mar. (In Rumanian)

The equations of motion of a nuclear electric rocket, that is, a nuclear rocket deriving its acceleration from a stream of charged particles, are derived. Take-off from the earth's surface and from a circular orbit near the earth is considered. It is shown that the nuclear electric rocket will develop only very weak thrusts, but over a long time period it can attain very high velocities. If the ratio of weight of the empty rocket to the power of the machinery $M/E \sim 1$ to 10 kg/kw and the mass ejection rate of its accelerators $m \sim 0.2$ to 2 mg/sec-ton, the nuclear electric rocket can be used for interplanetary travel from circular orbits around the planets. (J.S.R.)

12802

THE EFFECTS OF MERCURY VAPOR ON THE REGRESSION OF LATENT IMAGES IN PHOTOGRAPHIC EMULSIONS. M. Nicolae and F. Grünberg. Acad. rep. populare Române, Inst. fiz. Studii cercetări fiz. **7**, 223-4(1956) Jan.-Mar. (In Rumanian)

12803

CORRECTION OF THE SPHERICAL ABERRATION IN BETA SPECTROMETERS WITH THIN LENS. A. Gel-

berg. Acad. rep. populare Române, Inst. fiz. atomice si Inst. fiz. Studii cercetări fiz. **9**, 31-8(1958). (In Rumanian)

The calculation of the compensation for the spherical aberration of thin magnetic lens is made by means of a toroidal compensation coil. The image of the lens is completed by a term corresponding to the action of the compensation coil. The calculation is referred to the case of a point object placed on the principal axis of the lens. The lens field is assumed to be bell-shaped. (tr-auth)

12804

DIMENSIONING OF SHIELDING WALLS AGAINST γ -RAYS. L. Tihanyi. Acta Tech. Hung. **21**, 255-74 (1958).

The usual tabular method of calculating dimensions of nuclear shields is compared with a simpler graphical method proposed. This method enables thickness of Pb walls to be determined accurately, even when a number of different isotopes are present together. It provides for their additive radiation effect by a determination of the resultant dose-rate for nonenergetic, cascade, or series disintegration. The construction and use of the graphs is explained. (TCO)

12805

EQUIPMENT FOR THE DETERMINATION OF MAGNETIC SUSCEPTIBILITIES. J. A. McMillan (Instituto de Física de San Carlos de Bariloche, Argentina). Am. J. Phys. **27**, 352-4(1959) May.

Equipment for the determination of magnetic susceptibilities by the Gouy method utilizing an electromagnet and a Westphal specific gravity balance is described. Using Mohr's salt as a standard, the paramagnetism of salts like pentahydrated copper sulphate can be determined within 4%. The diamagnetism of some substances, such as water, can also be measured to one significant figure. Experimental results are given. (auth)

12806

SOME RESULTS ON STRIATIONS IN NEON GLOW DISCHARGES. Herbert Achterberg and Johannes Michel (Univ. of Greifswald, Ger.). Ann. Physik **2**, 365-79 (1959). (In German)

The manner in which external conditions affect the properties of striations in neon was investigated. Suitable precautions for the avoidance of these influences are given. By the production of artificial striations with sinusoidal voltages, it is possible to measure the properties of the striations without external influences. (tr-auth)

12807

ON FLAMMERSFELD'S RANGE-ENERGY RELATION FOR ELECTRONS. Yatendra Pal Varshni and Ramesh Chandra Karnatak (Allahabad Univ., India). Ann. Physik **2**, 413-20(1959).

Flammersfeld's range-energy relation for electrons in aluminum was examined. It is found that it is satisfactory for $E > 0.2$ Mev. For lower energies a power relation $E = CR^m$ is suitable. dE/dR as calculated from these equations differs considerably from the theoretical results. Possible reasons for the discrepancy were discussed. (auth)

12808

BAND SPECTRA OF GALLIUM HYDRIDE AND GALLIUM DEUTERIDE. H. Neuhaus (Univ. of Stockholm). Arkiv Fysik **14**, 551-6(1959). (In German)

The results of the analysis of the triplet-singlet

intercombination system in the yellow wave length range of gallium hydride and deuteride are reported. The value of the multiplet splitting ($\Delta T = 280 \text{ cm}^{-1}$) between the terms with $\Omega = 0$ and 1 is in good agreement with the theoretically calculated value. In the violet range of the GaH spectrum a diffuse absorption continuum appears. It is explained as a $1\pi-X^1\Sigma^+$ system. (tr-auth)

12809

A NUMERICAL METHOD FOR SOLVING TWO-DIMENSIONAL DIFFUSION EQUATIONS. N. I. Buleev. *Atomnaya Energ.* 6, 338-40(1959) Mar. (In Russian)

A relaxation method, which is a combination of factorization and consecutive approximations, is suggested for solving two-dimensional diffusion equations. (R.V.J.)

12810

THE SETTLING BEHAVIOUR OF URANIUM TRIOXIDE-WATER SLURRIES. A. W. Boyd and J. L. Whitton. *Can. J. Chem. Eng.* 36, 277-81(1958) Dec.

Settling rates of UO_3 -water slurries in the range of 100 to 800 grams/liter at temperatures of 25 to 53°C are measured. The applicability of several equations to relate the rate of hindered settling to surface area, concentration, and viscosity was examined. (TCO)

12811

A NEW CLASSIFICATION OF THE ELEMENTS. Rose Aynard. *Compt. rend.* 248, 2165-7(1959) Apr. 13. (In French)

A new classification system of the elements based on the electron shell structure of the atom and their magnetic properties is presented. (J.S.R.)

12812

STUDY OF THE REPRODUCIBILITY OF THE WAVE LENGTH OF THE RADIATION $2p_{10}-5d_5$ OF KRYPTON-86, STANDARD PROPOSED FOR THE LENGTH UNIT. Jean Terrien. *Compt. rend.* 248, 2171-2(1959) Apr. 13. (In French)

The variations of the wave length with the direction and intensity of the current or with the krypton pressure were measured and extrapolated to zero pressure and current to obtain the nonperturbed wave length. The wave length was defined with a relative precision of 2×10^{-9} . (tr-auth)

12813

STUDY OF COSMIC RAYS AND TERRESTRIAL CORPUSCULAR RADIATION BY COSMIC ROCKET. S. N. Vernov, A. E. Chudakov, P. V. Vakulov, and Yu. I. Logachev. *Doklady Akad. Nauk S.S.S.R.* 125, 304-7(1959) Apr. 11. (In Russian)

Preliminary data are presented on the corpuscular terrestrial radiation and cosmic rays measured at 8000 to 150,000 km from the earth's center. The particles were measured with two Geiger counters ($1 \times 5 \text{ cm}$ and $1.8 \times 10 \text{ cm}$) and a scintillation counter with NaI crystal $39 \times 40 \text{ mm}$ (capable of measuring events with energy threshold at 45, 450, 4500 keV and total ionization) all placed inside an aluminum shell 1 g/cm^2 in thickness, with 20% of solid angle screened with additional material ($\sim 10 \text{ g/cm}^2$). A second scintillation counter was placed outside the screened shell and protected on the open side by 7μ (1.9 mg/cm^2) of aluminum foil. The rocket trajectories and radiation intensities are plotted. (R.V.J.)

12814

ON THEORY OF NON-IDEAL BOSE GAS. Yu. V. Sanochkin (Lebedev Inst. of Physics, Academy of

Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* 125, 308-10(1959) Apr. 11. (In Russian)

Formulas were derived for the normal state of energy and for the single Bose excitation spectrum with considerations for the Hamiltonian signs, previously omitted by N. N. Bogolyubov. The Hamiltonian obtained by the partial summation of diagrams is somewhat different from the Hamiltonian developed by K. Brueckner and K. Sawada, *Phys. Rev.* 106, 1117 (1957), to which was adapted the principle of the "dangerous" diagram compensation. Besides, indications were found of the absence of the slit in the spectrum and of a certain modified interaction potential participating in the expression of elementary excitation energy, which permits the investigation of singular potentials. (R.V.J.)

12815

METHOD OF GREEN'S FUNCTIONS IN QUANTUM STATISTICS. E. S. Fradkin. *Doklady Akad. Nauk S.S.S.R.* 125, 311-14(1959) Apr. 11. (In Russian)

A system of functional equations for the integral of state in quantum statistics was developed previously by E. S. Fradkin (*Doklady Akad. Nauk* 125, No. 1, (1959)). A set of Green's functions is offered for the solution of the above functions. In order to apply the results to high- and low-energy processes, the derived set of expressions was formulated with considerations for relativistic corrections. (R.V.J.)

12816

TERBIUM-BORON COMPOUNDS AND THE ELECTRONIC CONFIGURATION OF THE TERBIUM ATOM. Yu. B. Paderno, T. I. Serebryakova, and G. V. Samsonov (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* 125, 317-18(1959) Apr. 11. (In Russian)

Studies were made of boron terbium compounds (of two possible configurations $4f^8 5d^1 6s$ or $4f^8 6s^2$) prepared by terbium oxide reduction by boron carbide and by boron: $\text{Tb}_2\text{O}_3 + 3\text{B}_4\text{C} = 2\text{TbB}_6 + 3\text{CO}$; $\text{Tb}_2\text{O}_3 + 15\text{B} = 2\text{TbB}_6 + 3\text{BO}$. In both cases the reduction lasted an hour at 1650°C. The boron-reduced preparation was blue, while the boron carbide-reduced material was grey-brown; the first product was the terbium hexaboride with lattice space $a = 4.11 \text{ \AA}$, and the second was tetraboride with a tetragonal lattice $a = 7.13 \text{ \AA}$, $c = 4.07 \text{ \AA}$. The results verified the existence of TbB_4 and TbB_6 . Results of x-ray studies are tabulated. (R.V.J.)

12817

ON β -MODIFICATION OF SPODUMENE. V. E. Plyushev, Yu. P. Simanov, and I. B. Shakhno (Lomonosov Moscow State Univ.). *Doklady Akad. Nauk S.S.S.R.* 125, 334-6(1959) Apr. 11. (In Russian)

X-ray studies were made of a dehydrated dense β spodumene (66.34% SiO_2 , 27.58% Al , 0.22% CaO , 0.12% Na_2O , 0.12% K_2O , 6.05% Li_2O , and traces of Fe_2O_3 and MgO). The modification was reached after 6 hours at 1100°C. The results for the β spodumene powder in tetragonal axis was $a = 13.15 \text{ kX}$ and $c = 11.64 \text{ kX}$. The x-ray picture indexed 54 strong and 3 weak lines. The roentgenographic density of β spodumene at $Z = 16$ formula units in the elementary cell was $\sigma_x = 2.437$, in good agreement with the experimental value $\sigma_{\text{max}} = 2.438$. (R.V.J.)

12818

CONDITIONS FOR THE SEPARATION OF THE SOLUTIONS OF A LINEAR PARABOLIC EQUATION INTO ORTHOGONAL COMPONENTS. N. N. Rykalin.

Doklady Akad. Nauk S.S.S.R. **125**, 519-22(1959) Mar. 21 (In Russian)

The theorem developed for separation can be used for deriving the expressions for spatial alignment processes such as unstable head conductivity, diffusion, filtration, neutron breeding, and others described by linear parabolic equations in a source distribution action (in homogeneous or orthotropic unlimited space or bodies which intersect simpler geometrical images) derived from the known equations for the linear or plane process components. The theorem of separation can be used in engineering problems on heat conductivity, metal heating, thermal treatment, and local friction. (R.V.J.)

12819

THE NATURAL RADIOACTIVITY OF SOME GLASSES. H. Drost and H. Puppe (Deutsche Akademie der Wissenschaften, Berlin). Exptl. Tech. Physik **7**, 20-6 (1959). (In German)

Some glasses of the firms Thüringer Glaswerke, Jenaer Glaswerke Schott & Gen., Glaswerk Fischer, Ilmenau, and VEB Spezialglaswerk "Einheit" were tested with a counter arrangement for radioactivity. The results show that the activity of the glasses is very low and can scarcely cause secondary effects. However, the use of a special glass must be decided for each individual case. (tr-auth)

12820

A NEW MULTIGROUP TREATMENT OF NEUTRON DIFFUSION IN MULTIPLYING MEDIUM. APPLICATION TO THE CORRECTION OF PERTURBATIONS TO THE THERMAL AND FAST FLUX IN THE VICINITY OF A REFLECTOR, A NEUTRON SOURCE, OR A DIFFERENT LATTICE. J. Martelly (Commissariat à l'Énergie Atomique, Paris). J. Nuclear Energy **8**, 1-17 (1958) Nov. (In French)

The calculation is carried through for the linear combination covering all the neutron groups in two cases of perturbation, a neighboring source of fissions, and a reflector. The results are expressed in a two-group formula by means of the weighing coefficients. (W.D.M.)

12821

THE EFFECT OF A CURRENT BOUNDARY CONDITION ON CONTROL ROD EFFECTIVENESS. Bertram Wolfe (General Electric Co., San Jose, Calif.). J. Nuclear Energy **8**, 63-5(1958) Nov.

The Hurwitz-Roe one-group, constant source, control rod theory was evolved on the basis of a zero thermal flux condition at the control element surface. By using the methods of Wolfe, the effects of a current boundary condition is examined. One- and two-group treatment is considered. (W.D.M.)

12822

NEUTRON FLUX DISTRIBUTIONS IN MEDIA SEPARATED BY A CYLINDRICAL BOUNDARY. A. E. Glauberman and I. I. Talianskii (Talianskiy). J. Nuclear Energy **8**, 84-90(1958) Nov.

Expressions are derived for the neutron flux distribution due to a point source on the axis of cylindrical symmetry of two coaxial media of different properties. The two-group approximation is used, and the transfer of neutrons between the two media is represented by the introduction of fictitious neutron source distributions over the boundary. Expressions are given for the fast and slow-neutron flux distributions in both media. (auth)

12823

THE PRODUCTION OF INTENSE ION PULSES OF LESS

THAN 5×10^{-10} SEC DURATION. N. N. Flerov and E. A. Tamanov. J. Nuclear Energy **8**, 91-2(1958) Nov.

A method for the production of intense neutron pulses, similar to that used in klystrons for the production of short electron pulses, was developed. Ions enter the system at different times with differing speeds but are caused to group together and strike a target in a very short time interval. The arrangement of the apparatus is illustrated. (W.D.M.)

12824

OBSERVATIONS OF THE LITHIUM LINES IN THE TWILIGHT AIRGLOW IN THE NORTHERN HEMISPHERE. A. Vallance Jones (Univ. of Saskatchewan, Saskatoon, Can.). Nature **183**, 1315-16(1959) May 9.

The possibility of marine and meteoric origins for the lithium lines in the twilight airglow in the northern hemisphere is considered. Meteoric origin is favored because the derived abundance ratio lithium/sodium agreed better with the ratio for the meteoric material. A third possibility suggested is that the lithium originates from hydrogen bomb tests at high altitude. Spectra covering the region 6000 to 7000 Å show the lithium abundance to be between the values for sea water and meteors, and can not be considered as decisive evidence against either hypothesis. As to the possibility of lithium arising from bomb tests, it is possible that the lithium detected above Saskatoon is a remnant of that introduced into the air by the Johnston Island test. (A.C.)

12825

INTERRELATION BETWEEN HARDNESS AND MODULUS OF ELASTICITY OF PURE METALS AT HIGH TEMPERATURES. M. G. Losenskii and S. G. Fedotov. Neue Hütte **3**, 489-94(1958) Aug. (In German)

Vickers hardness measurements at 20 to 1100°C for Pt, Pd, Rh, Ir, W, Mo, Ti, Zr, Te, Ni, Co, Ag, and Cu are tabulated. The relation between hardness and Young's modulus is studied graphically. (TCO)

12826

THE VAN ALLEN RADIATION BELT AND ITS POSSIBLE ORIGINS. Henry Elliott. New Scientist **5**, 787-90(1959) Apr.

The very intense radiation belt which surrounds the earth at heights greater than five or six hundred miles is discussed. The results from the U. S. and U.S.S.R. space probes and satellites are summarized. Possible origins of the radiation which are discussed are a by-product of cosmic rays, solar flares, and high-altitude nuclear explosions. (W.D.M.)

12827

NUCLEAR MAGNETIC SHIELDING AT LARGE DISTANCES OF A HYDROGEN ATOM IN AN ELECTRIC FIELD. H. F. Hameka (Carnegie Inst. of Tech., Pittsburgh). Nuovo cimento (10) **11**, 395-400(1959) Feb. 1.

The nuclear magnetic shielding constant of a hydrogen atom in a uniform electric field is calculated at a point P which is situated at a large distance from the nucleus in the direction of the electric field. The main term of the screening constant is found to be proportional to the first power of the electric field and to the inverse second power of the distance between P and the hydrogen nucleus. (auth)

12828

VISCOSITY OF BINARY MIXTURES OF HYDROGEN ISOTOPES AND MIXTURES OF He AND Ne. A. O. Rietveld, A. Van Isterbeek, and C. A. Velds (Kamerlingh

Onnes Lab., Leiden). *Physica* **25**, 205-16(1959) Mar.

The coefficient of viscosity of mixtures H_2 -HD, H_2 -D₂, HD-D₂, and He-Ne was determined, using the method of the oscillating disk at 293, 230, 195, 90, 70, 20, and 14°K and at different concentrations. The results are compared with the results calculated from a Lennard-Jones potential and the appearing differences are discussed. (auth)

12829

THE INDUCTION OF ELECTRICAL CONDUCTIVITY IN IRRADIATED POLYMERS. L. Holland. *Plastics (London)* **24**, No. 258, 112-14(1959) Mar.

Plastic materials are often used as electrical insulators in apparatus exposed to high-energy radiations such as x rays and high-energy electrons. Irradiation at energy levels apparently less than that required to cause either cross-linking or degradation can still produce changes in the electrical conductivity of an exposed polymer. Usually the conductivity rises during irradiation and decays very slowly after treatment. A short introductory review is made of the effects of high-energy radiations on polymers followed by a survey of the literature dealing with induced electrical conductivity in irradiated plastics. In conclusion it is shown that irradiation may alter the surface properties of a plastic material, e.g., render it hydrophilic. Undoubtedly such changes must influence the electrical conductivity of the surface, but this was not investigated. (auth)

12830

THE DESCRIPTION OF THE EJECTED ELECTRON IN K-SHELL IONIZATION. A. M. Arthurs (Queen's Univ. of Belfast). *Proc. Phys. Soc. (London)* **73**, 681-4(1959) Apr.

Merzbacher and Lewis recently reviewed the treatment of K-shell ionization of atoms on the basis of the Born approximation. They emphasized the importance of the screening effect of the outer electrons which causes the actual K-shell ionization potential to be somewhat less than the approximate value corresponding to the hydrogenic model adopted in theoretical work. There are two quite different methods of describing the ejected electron. One, due to Beth, has been used in the treatment of nuclear impacts, while the other, due to Stobbe, Massey, and Mohr, has been used in the treatment of photon and electron impacts. The principle aim in both methods is simply to ensure that the threshold of the calculated cross section energy curve coincides with the threshold of the corresponding observed curve. A quantitative comparison of the two methods has not been made. (A.C.)

12831

CONTRIBUTION TO THE DESIGN AND CALCULATION OF WELDED HOLLOW BODIES FOR HIGH PRESSURES AND TEMPERATURES. A. F. Maier. *Soudage* **12**, 402-12(1958) Nov.-Dec. (In French)

A study of the influence of stress conditions on distortion of hollow bodies is presented. Various constructions of heavy gauge vessels of large dimensions are compared. Determination of stress distribution, tendency to distortion, and breaking strength are discussed. (auth)

12832

AN EXPERIMENTAL DETERMINATION OF SPECIFIC VOLUMES OF HEAVY WATER. V. A. Kirillin and S. A. Oulibin. *Teploenergetika* No. 4, 67-72(1959) Apr.

Results of experiments into specific volumes of heavy

water at temperatures from 250 to 500°C and under pressures from 100 to 500 kg/cm² are given. (TCO)

12833

EQUATION AVERAGING OF RADIATIVE ENERGY TRANSFER. V. A. Prokof'ev. *Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim.* **13**, No. 2, 57-66(1958). (In Russian)

The mathematical analysis of energy transfer in emitting, absorbing, and scattering media can be accomplished by two methods. The first method, which was previously described, applied various numerical calculations (programmed on electronic devices) or approximation equations. The second method, which is now described, is based on the approximation of ratios between the integrals containing intensities. Ordinary differential equations derived by this method are not related to the intensities but to certain integral characteristics which have their own importance in the mechanics of motion of the emitting medium. The analysis is extended to the nonstationary radiation field in moving media considering the mechanical emission action (radiation pressure and internal radiant energy) and the transition with "semi-spherical" and full current. (R.V.J.)

12834

ABSORPTION OF RADIO WAVES IN NON-STEADY AND NON-LINEAR PROCESSES. L. K. Nerovnya. *Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim.* **13**, No. 2, 93-102(1958). (In Russian)

The wave energy losses in nonsteady processes, the linear Bonch-Bruевич effect, and the dependence of the electromagnetic wave absorption on its amplitude, the non-linear Bonch-Bruевич effect, are analyzed. (R.V.J.)

12835

KINETICS OF ELECTRONS IN ELECTROMAGNETIC FIELD OF IONIZED MAGNETIC MANOMETER AND ION PUMP. G. V. Smirnit'skaya and E. M. Reichrudel. *Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim.* **13**, No. 2, 121-32(1958). (In Russian)

A theoretical analysis is made of electron kinetics in nonuniform electric and longitudinal magnetic fields, approaching at low pressure the field distribution in an ionic manometer and pump. The calculations do not consider the spatial charge and hold good only for discharge before ignition and for glow discharge at low pressure (10^{-6} to 10^{-8} mm Hg) with current density not exceeding 10^{-6} a/cm². The studies of charged particle kinetics in selected conditions in vacuum permit the determination of the processes of low-pressure discharge in magnetic fields and the field values E and H for the discharge at 10^{-6} to 10^{-7} mm Hg pressure. (R.V.J.)

12836

THE FORMATION OF MOLECULAR IONS IN STATIONARY RARE GAS DISCHARGE. M. Pahl (Max-Planck-Gesellschaft, Hechingen, Ger.). *Z. Naturforsch.* **14a**, 239-46(1959) Mar. (In German)

As a supplement to the recently reported mass spectrographic measurements on ion effusion currents from stationary positive low-pressure columns in He and Ne (*Z. Naturforsch.* **13a**, 753(1958)), new results for argon, obtained with similar methods, are reported. Whereas in the Ne and He discharge the measured effusion current of the atomic ions X essentially corresponded to the predictions of the Schottky theory of ambipolar diffusion, smaller values were found in Ar.

The formation rate X_2/X in dependence on the pressure is approximately equal in He and Ne, but in Ar it is considerably higher. From the results it appears that in the stationary positive column ($p \leq 5$ torr) the formation of the molecular ion X_2^+ occurs preponderately by the process $X' + X \rightarrow X_2^+$ found by Hornbeck and Molnar at low pressures. (tr-auth)

12837

SPECIFIC HEATS OF $\text{PrCl}_3 \cdot n\text{H}_2\text{O}$ AND $\text{LaCl}_3 \cdot n\text{H}_2\text{O}$ IN THE TEMPERATURE RANGE BETWEEN 4.8°K AND 260°K. K. H. Hellwege, U. Johnsen, and W. Pfeffer (Technischen Hochschule, Darmstadt, Ger.). *Z. Physik* 154, 301-9(1959). (In German)

The specific heats of the isomorphous salts $\text{PrCl}_3 \cdot n\text{H}_2\text{O}$ and $\text{LaCl}_3 \cdot n\text{H}_2\text{O}$ were investigated calorimetrically between 4.8 and 260°K. The difference was compared with the specific magnetic heat of $\text{PrCl}_3 \cdot n\text{H}_2\text{O}$ calculated from spectroscopic data. From the specific heats, the specific entropies of both salts were calculated. (tr-auth)

12838

A REMARK ON THE SPIN-SPIN INTERACTION IN HYDROGEN ATOMS. K. Helmers (Physikalischen Staatsinstitut, Hamburg). *Z. Physik* 154, 310-11 (1959). (In German)

The magnetic hyperfine structure of the hydrogen ground state is derived from nonrelativistic quantum mechanics and is thus shown to be not an essentially relativistic effect as might appear from previous derivations. (auth)

12839

THE APPLICATION OF THE SCHOTTKY DIFFUSION THEORY TO DISCHARGES WITH MANY ION SPECIES AND EXCITED NEUTRAL PARTICLES. J. Wilhelm (Deutschen Akademie der Wissenschaften, Berlin). *Z. Physik* 154, 361-75(1959). (In German)

General considerations on the homogeneous column in a longitudinal direction of a glow discharge show that the diffusion theory in the presence of many species of ions and excited neutral particles with constant carrier motion and carrier balance coefficients is always resolvable with known functions when there exists proportional concentration distribution across the cross section. Considerations with respect to the integration constants appearing show that—as far as one is moving in the range of analytical solutions—this is the case only when the concentration ratios in the discharge center are completely defined by the carrier motion and carrier balance coefficients. More general solutions are given by deviations or by nonanalytical characters. Solutions are given for two simple examples of discharges. (tr-auth)

12840

MEASUREMENTS ON THE ENERGY AND Z DEPENDENCE OF THE MOTT SCATTERING ASYMMETRY. H. Bienlein, G. Felsner, K. Güthner, H. v. Issendorff, and H. Wegener (Univ. of Erlangen, Ger.). *Z. Physik* 154, 376-82(1959). (In German)

With monoenergetic electrons of 120 to 210 kev the asymmetry of Mott scattering for the elements Au, Ce, Ag, and Cu is measured at constant scattering angle of 120°. At large energies the calculations of Sherman were confirmed; at small energies the experimental values are smaller because of screening. (auth)

12841

INVESTIGATION OF THE CORE OF EXTENSIVE ATMOSPHERIC SHOWERS. S. N. Vernov, N. N.

Goryunov, G. T. Zatsepin, G. V. Kulikov, Yu. A. Nechin, Z. S. Strugalskii, and G. B. Khristiansen (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 669-81(1959) Mar. (In Russian)

A new method for individual study of extensive atmospheric showers is described. The method is applied to study the core of extensive atmospheric showers. Some preliminary experimental data are presented which indicate the existence of sharp fluctuations in the energy flux of the electron-photon and nuclear-active components of the core of extensive atmospheric showers. (auth)

12842

SOME PECULIARITIES OF MULTIPLY FERROMAGNETIC RESONANCE IN FERRITES. V. N. Lazukin (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 682-9(1959) Mar. (In Russian)

Preliminary results of observation of the multiplet ferromagnetic resonance in inhomogeneously magnetized single and polycrystalline ferrite samples are presented. The inhomogeneous magnetizations required for observation of the effect were mainly produced by the inhomogeneity of the demagnetizing fields of the investigated samples. Some peculiarities of the absorption spectra measured under various conditions are indicated. (auth)

12843

INVESTIGATION OF HIGH CURRENT PULSE DISCHARGES IN CONICAL CHAMBERS. N. A. Borzunov, D. V. Orlinskii, and S. M. Osovets. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 717-26(1959) Mar. (In Russian)

Some general considerations are presented concerning the possibility of forming an accumulative jet upon contraction of a conical plasma envelope. Preliminary results of some experiments performed with so-called single and double conical systems are presented. Photographs of the discharge in conical chambers are presented along with some measured results. (auth)

12844

CONVERGING CYLINDRICAL DETONATION WAVE. Ya. B. Zeldovich. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 782-92(1959) Mar. (In Russian)

The properties of detonation waves close to the normal detonation wave are considered. A theory of amplification of a cylindrical converging detonation wave is proposed which exactly describes the amplification during the start of the process. By comparison with numerical computations it is shown that the theory remains satisfactory for small radii and appreciable amplification of the wave. (auth)

12845

CONTRIBUTION TO THE THEORY OF COHERENT SPONTANEOUS RADIATION. V. M. Fain (Gor'kii State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 798-802 (1959) Mar. (In Russian)

Some problems relating to the theory of coherent spontaneous radiation are considered. It is shown that the interaction of the particles via the common radiation field leads to a shift in the proper frequencies of the system. (auth)

12846

ON INDIRECT INTERACTION BETWEEN d-ELECTRONS OF THE TRANSITION METALS. I. FERROMAGNETISM. A. A. Berdyshev and B. V. Karpenko (Ural State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 819-22(1959) Mar. (In Russian)

The second approximation of the perturbation theory for the s-d model of the transition metals yields an indirect interaction between d-electrons in which the conductivity electrons are involved. As a consequence, ferromagnetism may arise when s-d coupling is completely absent or even when the d-d exchange integral is negative. (auth)

12847

INVESTIGATION OF A CURRENT-CARRYING RING UNIFORMLY MOVING IN A PLASMA LOCATED IN A MAGNETIC FIELD. L. S. Bogdankevich (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 835-8(1959) Mar. (In Russian)

Energy losses due to Vavilov—Cherenkov radiation are computed for a current-carrying ring uniformly moving in a plasma perpendicular to its plane and parallel to the external magnetic field. (auth)

12848

OSCILLATIONS OF A CYLINDRICAL CAVITY IN A COMPLETELY IONIZED PLASMA. L. M. Kovrizhnykh (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 839-41 (1959) Mar. (In Russian)

Oscillations of a cylindrical cavity in a completely ionized plasma located in a magnetic field are investigated within the framework of magnetohydrodynamics under the assumption of ideal conductivity. It is shown that such a system is stable and that under definite conditions the waves cannot propagate along the cavity. (auth)

12849

THEORY OF THE NONLINEAR FIELD ($\square - \lambda\varphi^2$) $\varphi = 0$. D. F. Kurdgelaidze (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 842-9(1959) Mar. (In Russian)

A nonlinear field described by the equation ($\square - \lambda\varphi^2$) $\varphi = 0$ is considered. A spectral expansion of the energy of the nonlinear field is given on the basis of the exact solution of the field equation. A mass spectrum of the type $M_0^{(n)} = (2n + 1)M_0^{(0)}$, $n = 0, 1, 2, \dots$ was obtained. An exact radially-symmetric solution of the field equation was derived. A general method for integrating the nonlinear Dirac equation is presented and it is shown that in some cases one can pass to a two-component spinor equation of the second order. (auth)

12850

ON A CERTAIN VARIANT OF NONLOCAL ELECTROMAGNETIC FIELD THEORY. A. A. Komar and M. A. Markov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 854-8 (1959) Mar. (In Russian)

A nonlocal theory is considered which corresponds to a modification of the Lienard-Wiechert potential. It is demonstrated that if an equation of the usual type is assumed to hold for potential in the theory under consideration one finds in a consistent relativistic treatment (many-time formalism) that contradictions appear already within the framework of the classical theory. (auth)

12851

ON THE INTERACTION BETWEEN CONDUCTIVITY ELECTRONS IN FERROMAGNETICS. A. I. Akhiezer and I. Ya. Pomeranchuk (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 859-62(1959) Mar. (In Russian)

It is shown that in ferromagnetics there is an additional attraction between conductivity electrons which is due to exchange of the spin waves. (auth)

12852

FIELD THEORY MODEL WITH A NONVANISHING RENORMALIZED CHARGE. A. A. Anselm (Inst. of Physics and Tech., Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 863-8(1959) Mar. (In Russian)

Two fermion fields are considered in a unidimensional space (and time), each of these fields interacting with each other and with themselves. The first term in the expansion of the vertex part in an asymptotic series of a well known form was obtained. It is shown that under certain conditions the renormalized charge may possess an arbitrary (nonvanishing) value. (auth)

12853

GROUP-THEORETIC TREATMENT OF THE FOUNDATIONS OF RELATIVISTIC QUANTUM MECHANICS. [PART] V. Yu. M. Shirokov (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 879-88(1959) Mar. (In Russian)

A complete classification was obtained for all irreducible representations of the inhomogeneous Lorentz group including space and time reflections. It is shown that the concept of time parity cannot be introduced for particles with a nonvanishing rest mass; for particles with a nonvanishing rest mass two unequivalent concepts which differ in respect to space-time parity properties exist for a given spin. With the aid of the concept of a universal covering group, it is shown that for particles with half-integer spins the number of possible representations with various reflection laws is larger than has hitherto been assumed. (auth)

12854

FOCK EXPANSION FOR THE WAVE FUNCTIONS OF A SYSTEM OF CHARGED PARTICLES. Yu. N. Demkov and A. M. Ermolaev (Leningrad State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 896-9(1959) Mar. (In Russian)

The method applied by Fock for investigating the wave function of the 'S' state of helium is generalized for arbitrary systems of charged particles and for states of any symmetry. (auth)

12855

ON APPLICATION OF QUANTUM FIELD THEORY METHODS TO PROBLEMS OF QUANTUM STATISTICS AT FINITE TEMPERATURES. A. A. Abrikosov, L. P. Gor'kov, and I. E. Dzyaloshinskii (Inst. of Problems in Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 900-8(1959) Mar. (In Russian)

A formulation of the thermodynamic perturbation theory is proposed which permits the application of quantum field theory methods to quantum statistics at finite temperatures. The method is an extension of the Matsubara technique and is based on expansion of the Green's functions in Fourier series in an imaginary time variable. The technique thus arrived at differs from the usual diagram technique for $T = 0$ in that summation over discrete values of the imaginary frequency is substituted for integration over the frequencies. The analytical properties of Fourier components of Green's functions are investigated. It is shown that due to the possibility of analytic continuation

for solution of various kinetic and nonstationary problems, it is sufficient to know the corresponding equilibrium Green's functions. (auth)

12856

ON ONE RELATION IN QUANTUM STATISTICS. E. S. Fradkin (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 951-3(1959) Mar. (In Russian)

It is shown that statistical characteristics of matrix density can be determined by the mass operator for monomial Green functions. (R.V.J.)

12857

THERMODYNAMICS OF HELIUM. M. P. Mokhnatkin. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 963(1959) Mar. (In Russian)

An error is indicated in the formula used by B. N. Esel'son et al. (JETP 33, 936(1957)) in their contention that λ transitions in helium isotope solutions are phase transitions of the second order. An answer to this contention can be found in the Letter to M. P. Mokhnatkin, p. 964 of the same issue. (R.V.J.)

12858

THE ENTROPY OF GASEOUS MONATOMIC IONS. V. P. Vasil'ev, E. K. Zolotarev, and K. B. Yatsimirskii (Ivanovsk Chemical and Tech. Inst.). *Zhur. Fiz. Khim.* 33, 328-30(1959) Feb. (In Russian)

Employing statistical thermodynamic equations, entropy values were calculated for ions in the gaseous state for standard conditions. (auth)

12859

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 30. FUNDAMENTAL PHYSICS. Geneva, United Nations, 1958. 335p. \$10.50.

Papers from the Geneva Conference are presented on systematics of elementary particles, weak interactions, structure of the nucleus, cosmic-ray and very high energy phenomena, accelerators and bubble chambers, pions, antinucleons, and strange particles, electromagnetic interactions of elementary particles, and nuclear processes in stars. (W.D.M.)

12860

WAVE OPTICS AND ATOMICS. D. H. Tomboulion. Ithaca, N. Y., Cornell Univ., D. H. Tomboulion, 1958. 200p.

The propagation mechanism of radio and light waves is considered in relation to the laws of electricity and magnetism. In addition, the emission of electrons from metals and motion of electrons in magnetic fields are discussed as well as the photoelectric effect, thermionic emission, and secondary electron emission. Also included are full discussions of atomic and nuclear physics. (J.R.D.)

12861

DEVICE FOR MONITORING THE PROTON RESONANCE IN A LIQUID. (to Atomic Energy of Canada, Ltd.). British Patent 811,232. Apr. 2, 1959.

A chamber arrangement for analysis of heavy water by proton magnetic resonance spectroscopy is described. A flat cylinder which can be placed between the pole pieces of a magnet is equipped with D_2O inlets and outlets and a bubble outlet and an r-f coil. The D_2O to be analyzed enters the outer edge of the chamber and travels through a spiral delay region to the detecting

region near the r-f coil and thence out of the chamber. The r-f coil is insulated by Kel-F or Teflon. Temperature control means are also provided. (T.R.H.)

Elementary Particles

12862 NP-7445

Warsaw. Univ. Inst. of Physics and Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw. DETERMINATION OF THE MASS OF THE Λ^0 HYPERON. Report No. 66/VI. J. Bogdanowicz, M. Danysz, A. Filipkowski, E. Marquit, E. Skrzypczak, A. Wróblewski, and J. Zakrzewski. Feb. 1959. 8p.

A stack of 600 μ Ilford G-5 emulsion exposed to the K^- beam of the Berkeley Bevatron was searched for Λ^0 decays. Fifty-eight two-prong stars with a second outgoing track were analyzed and a histogram is presented. (W.D.M.)

12863 NP-7456

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.

REACTION $p + p \rightarrow p + p + \pi^0$ IN THE ENERGY RANGE FROM THE THRESHOLD TO 665 MEV. A. F. Dunaitzev and Yu. D. Prokoshkin. 1959. 32p.

The angular distributions of π^0 mesons produced in proton-proton collisions were investigated at 400 to 665 Mev. The distributions were found to be close to isotropic in agreement with the phenomenological resonance theory of S. Mandelstam. The total cross sections were measured in the energy range 313 to 665 Mev. At energies above 400 Mev the main contribution to the reaction cross section is given by the resonant transitions. At the lower proton energies the non-resonant Ss-transition becomes essential, its contribution to the total cross section being $0.032 \pi^2_{\text{m}} 10^{-27} \text{ cm}^2$. The comparison of the measured cross sections for neutral and charge pion production with those calculated from the resonance theory makes it possible to conclude that the transitions with the total angular momentum $J = 2$ becomes preferential. (auth)

12864 UCRL-8677

California. Univ., Berkeley. Lawrence Radiation Lab. A STUDY OF THE ANTIPROTON ANNIHILATION PROCESS IN COMPLEX NUCLEI (thesis). Theodore E. Kalogeropoulos. Mar. 8, 1959. 65p. Contract W-7405-eng-48. \$1.75(OTS).

The antiproton annihilation process in complex nuclei was studied in photographic emulsions. When a 19.8 gr/cm² LiH absorber was introduced in an existing antiproton beam, the antiproton-to-meson ratio improved by a factor of about 10, becoming 1/50,000. Thus in a single stack exposed to this improved beam, 165 antiprotons were found. These together with 20 more found in other stacks and the 36 reported in the "Antiproton Collaboration Experiment" (a total of 221 analyzed stars) are included in this analysis. From this analysis the annihilation process in complex nuclei can be interpreted to proceed as follows: The antiproton annihilates itself with one nucleon, transforming all the available energy mainly into π mesons of average multiplicity 5.36 ± 0.28 with an occasional K-K emission of frequency $(3.5 \pm 1.5\%)$ per star. The mesons interact with the nucleus leaving it in an excited state. The nucleus releases the excitation energy through nucleon emission. On the average, the stars in flight have more excitation than those at rest. By the use of this experimental data and available information on pion interactions in nuclear

matter, the fraction of interacting pions was deduced for the stars in flight and at rest separately. It is shown that with a better knowledge of the pion interactions in nuclear matter, antiproton annihilations can be used to investigate the nucleon distribution at the surface of the nucleus. The pion-pion angular distribution was deduced on the basis of energy-momentum conservation, by the use of the Fermi statistical model of the annihilation with Lorentz-invariant phase space. The theoretical distribution agrees with the experimental one if an adjustment of the interaction volume is made to account for the observed pion multiplicity. A strong pion-pion interaction is thus unlikely. (auth)

12865

THEORETICAL CONSIDERATION ON THE $\pi \rightarrow \mu$ DISINTEGRATION. Serban Titeica. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. 9, 411-27(1958). (In Rumanian)

Measurements made on the disintegration of pions at rest show that the angular distribution of muons emitted in the disintegration is anisotropic. This indicates that the spin of the pion is not equal to zero and that the particle is at least partially polarized at the moment of its disintegration. The angular distributions of muons for an arbitrary value of the spin J and an arbitrary polarization of the pion are calculated. For the cases $j = 1$ and $j = 2$, special expressions are derived. (tr-auth)

12866

AN "INTEGRAL" METHOD OF β SPECTROMETRY WITH HIGH PULSE LIMITATION. E. Friedländer and E. Ruckenstein. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. 5, 115-21(1954) Jan.-June. (In Rumanian)

A new method for the determination of the pulse spectrum of β -active elements is proposed. In opposition to usual methods in which the spectrum is registered differentially, in the present method the spectrum is recorded integrally, i.e., all the electrons which describe, in a homogeneous magnetic field, helicoidal trajectories with a radius lower than a given value R_0 are recorded. If $\beta_0 = eHR_0$ is the pulse limit corresponding to this radius, H is the value of the field, P_1 is the upper limit of the β spectrum, and N_0 is the number of β particles emitted by a source per unit time in the solid angle 2π , the determination of the pulse spectrum $F(P)$ dP is reduced to the recording of the curve $N(H)$ and the resolution of the integral equation

$$S(H) = N_0 - N(H) = \int_{P_1}^{P_0} \sqrt{1 - (P_0/P)^2} F(P) dP.$$

The solution is obtained by approximation of the equation with a system of linear algebraic equations. The resolving power of the method depends on the number n of subintervals in which the pulse interval is divided. The method is applicable to very weak radioactive sources. (tr-auth)

12867

CLASSICAL BASIS ON THE THEORY OF ELEMENTARY PARTICLES. Valer Novacu. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. 6, 171-216(1955) Apr.-June. (In Rumanian)

The different investigations made on the basis of classical physics to remove the inconveniences of the point electron are analyzed. The different attempts to extend the Lorentz classical electrodynamic fundamentals are reduced to the modification of the

Lagrangian expression occurring in the variational principle, from which the field and motion equations can be deduced. These attempts have led to results which give a new form to the problem of the electron mass and spin, as well as of elementary particles in general, and show the relation with the internal structure of the particle. For a comparison and a discussion of the results obtained from the introduction of the extended particle, the different theories are grouped in dualistic theories, non-local and unitary. 61 references. (tr-auth)

12868

EXPERIMENTAL STUDY OF THE N COMPONENT OF COSMIC RAYS AT ENERGIES OF ~ 25 Gev. I. MEASUREMENTS ON ELECTRON-NUCLEAR SHOWERS AT ENERGIES ABOVE 10 Gev. E. Friedländer, C. Iussim, and M. Mayer. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. 6, 229-36(1955) Apr.-June. (In Rumanian)

Measurements on electron-nuclear showers were made at different heights in the Bucegi mountains, by means of a coincidence counter arrangement, in order to test the efficiency of a method for the determination of the average energy of the generating particles, as well as of the pion to nucleon ratio in the N component of cosmic rays. The results so far obtained show that the study of the compensation effect allows the determination of these quantities in accordance with theoretical previsions. For the arrangement used, $\bar{\epsilon} \sim 25$ Bev, $N_{\pi\pm} \sim 2N_{\text{nucleons}}$ was found. (auth)

12869

EXPERIMENTAL STUDY OF THE N COMPONENT OF COSMIC RAYS AT ENERGIES OF ~ 25 Gev. II. CONCERNING THE STUDY, BY THE COMPENSATION METHOD, OF THE INTERACTIONS OF HIGH ENERGY COSMIC-RAY PARTICLES WITH NUCLEI IN THE ATMOSPHERE. E. Friedländer. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. 6, 237-43(1955) Apr.-June. (In Rumanian)

The data obtained in the course of experiments for the calibration (in average energy) of a nuclear shower detector can be used directly for the study of the previous cascade in the nuclear cascade process in the atmosphere. An expression is obtained, relating the measured quantities (the average energy $\bar{\epsilon}$ of the particles which trigger the detector and ρ = ratio of nucleons to pions in the N component at energy $\bar{\epsilon}$) and the average characteristics of the nuclear shower in the atmosphere, in which the particles triggering the detector have originated (the average energy E of the incident particle, the average multiplicity n of the shower, and the number ν of nucleons swept away from the target nucleus by the incident particle). A comparison between the experimental data and the theories of multiple meson generation, shows that these data are in contradiction with Heisenberg's theory but that they well fit Fermi's theory extended to nucleon-nucleus collisions. (auth)

12870

CONTRIBUTION TO THE PROBLEM OF THE NATURE OF THE PARTICLES WHICH GENERATE STARS IN NUCLEAR EMULSIONS. C. Bercea. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. 6, 343-7(1955) Apr.-June. (In Rumanian)

An analysis of the results obtained by Belovitch et al., (*Doklady Akad. Nauk S.S.S.R.* 69, 321(1949)) was made by assuming that the stars observed in the nu-

clear emulsions are generated by stable particles produced, at least partially, by collisions between pions and atmospheric nuclei. From a use of the compensation method, it is shown that the pion energy, obtained from the observed compensation effect, and the relative abundance of the mesons contradict the experimental data. (tr-auth)

12871

A STATISTICAL METHOD FOR THE DETERMINATION OF THE MASS AND LIFETIME OF NEUTRAL UNSTABLE PARTICLES. E. Friedländer. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **6**, 473-80(1955) July-Sept. (In Rumanian)

A statistical estimation of the mass of V^0 particles as well as of the decay products, assuming a two-body decay, can be made using the distribution of the Manchester parameter α and mean square \bar{p}_T^2 of the transverse momenta of the decay products. The position of the peak on the frequency histogram of the quantity $\sqrt{|\alpha - \alpha_0|}$ gives an auxiliary parameter α' which yields the three masses. Because of the relativistic time dilation, the shape of the histogram for $|\alpha - \alpha_0| > \alpha'$ can be used to estimate the order of magnitude of the V^0 lifetime. (auth)

12872

ON THE NATURE OF THE θ PARTICLES. E. Friedländer and J. Friedländer. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **6**, 769-80(1955) Oct.-Dec. (In Rumanian)

A statistical analysis of 64 cases of θ^0 decay observed in cloud-chambers, nuclear emulsions and in the cosmic-ray mass-spectrometer leads to the conclusion that the experimental results cannot be interpreted by the hypothesis of the existence of a single type of θ^0 particle with two decay schemes ($\theta^0 \rightarrow \pi^+ + \pi^-$ or $\theta^0 \rightarrow \pi^+ + \pi^- + \pi^0$). An analysis by the method of maximum probability shows that the data admit an interpretation in terms of two types of θ^0 particles with similar (two-body) decay schemes ($\theta^0 \rightarrow \pi^+ + \pi^-$) different masses ($\theta_1^0 \sim 972 m_e$, $\theta_2^0 \sim 600 m_e$) and widely differing life-times ($T_1 \sim 10^{-10}$ sec, $T_2 \gtrsim 10^{-9}$ sec). In these conditions the experimental results concerning the decay of the χ meson can easily be interpreted by the decay scheme $\chi^\pm \rightarrow \pi^\pm + \theta_2^0$, with $M_\chi \sim 1270 m_e$. (auth)

12873

A STATISTICAL COMPLEMENT TO THE CLASSICAL ELECTRON THEORY. Serban Titeica. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **7**, 7-13 (1956) Jan.-Mar. (In Rumanian)

In classical statistical analysis, the time variable t plays an exceptional role in the definition of the distribution function and in the Boltzmann equation which determines the evolution of the distribution. An invariant relativistic definition of the distribution function is given and an invariant Boltzmann equation is established. The results obtained are applied to the study of a group of charged particles which evolve under the action of a self-consistent field created by the group itself. (tr-auth)

12874

THE CLASSICAL THEORY OF THE ELECTRON, BASED ON NON-LINEAR ELECTRODYNAMICS. Valer Novacu. Acad. rep. populare Romîne, Inst. fiz. Studii cercetări fiz. **7**, 16-24(1956) Jan.-Mar. (In Rumanian)

The essential characteristics of a classical electron theory are studied, beginning with the hypothesis of a

moving electric fluid defined by the continuous distribution of the pulse and the energy, related to the unit of electric charge, or by the universal velocity distribution. The magnetic properties of the electron are defined by a polarization of the electric fluid. A variant of the Dirac electrodynamics is obtained from which the characteristics in common with non-linear electrodynamics are indicated. (tr-auth)

12875

KLEIN PARADOX FOR THE KLEIN-GORDON EQUATION. Rolf G. Winter (Pennsylvania State Univ., University Park). Am. J. Phys. **27**, 355-8(1959) May.

The behavior of a beam of spin-zero particles incident on a region of large potential increase is examined. The results are compared with those obtained from similar computations employing the Dirac equation. This comparison yields an instructive illustration of the difference between particles and antiparticles in spin zero and spin one-half single-particle theory. (auth)

12876

ENERGY AND ANGULAR DISTRIBUTION OF SCATTERED RADIATION IN A WATER TANK IRRADIATED BY X-RAYS. G. Hettinger and N. Starfelt (Univ. of Lund, Sweden). Arkiv Fysik **14**, 497-511(1959).

The spectral distribution of scattered x rays in different directions in a water phantom was studied with the aid of a NaI(Tl) scintillation spectrometer. The primary radiation consisted of heavily filtered x rays from a commercial x-ray generator with a maximum voltage of 300 kv. The experimentally determined spectra, differential in energy and angle, were integrated over all angles to give the photon number flux at different primary energies and water depths. (auth)

12877

THERMAL NEUTRON CAPTURE γ -RAYS. L. V. Groshev, B. I. Gavrillov, and A. M. Demidov. Atomnaya Energ. **6**, 281-9(1959) Mar. (In Russian)

The γ -ray spectra from (n, γ) reactions were studied by means of a magnetic Compton spectrometer in the Academy of Science water reactor. Test procedures are described, and the results of measurements on tin and antimony absorbers are given. (tr-auth)

12878

ON THE POSSIBILITY OF ACCELERATION OF POLARIZED PROTONS IN A CYCLOTRON. G. M. Budyanskii, Yu. A. Zavenyagin, N. D. Fedorov, and V. A. Kharabrov. Atomnaya Energ. **6**, 306-10(1959) Mar. (In Russian)

The probability of spin pre-orientation in acceleration of polarized protons in a cyclotron, with magnetic field falling along the radius and azimuthal heterogeneity, was estimated. The beam emission from the chamber was studied. It is shown that the probability of depolarization in acceleration and emission of particles is very small. (tr-auth)

12879

AN EXPERIMENTAL CONFIRMATION OF THE THEORY OF NEUTRON DIFFUSION IN A MEDIUM WITH CAVITIES. I. F. Zhezherun. Atomnaya Energ. **6**, 311-14(1959) Mar. (In Russian)

Descriptions are given of experiments carried out in order to confirm the theory of thermal neutron diffusion in graphite. Measurements of neutron flux in a continuous graphite medium and in a graphite medium with cavities confirmed the theoretical formulas combining

the effective coefficients of thermal neutron diffusion (and the diffusion length) in the cavities with the channel lattice parameters and the corresponding diffusion coefficients (and diffusion length) in a continuous medium. (tr-auth)

12880

QUASI ELASTIC SCATTERING OF FAST NUCLEONS BY LIGHT NUCLEI. INFLUENCE OF THE COMPLEX POTENTIAL. Nadine Bessis. Compt. rend. **248**, 2168-70 (1959) Apr. 13. (In French)

The differential cross section for the quasi elastic scattering (p,pn) and (p,2p) of 155- and 340-Mev protons was calculated with a consideration of the wave distortion of the incident proton and of the two nucleons emitted by complex nuclear potential. The effect of this correction on the choice of the moments distribution of the nucleons of the target nuclei is studied. The theoretical results are applied to the study of the $C^{12}(p,2p)B^{11}$ reaction. (tr-auth)

12881

DETERMINATION OF THE FLUX MOMENTS IN THE SLOWING DOWN OF NEUTRONS FROM A PLANE SOURCE IN A INFINITE MEDIUM BY MEANS OF A MONTE-CARLO METHOD. J. Lafore and J.-P. Millot (Centre d'Études Nucléaires, Fontenay-aux-Roses, France). Inds. atomiques **3**, No. 1-2, 50-3 (1959). (In French)

The slowing down flux for neutrons in an infinite medium was calculated using the method of moments. The moments were determined by the Monte Carlo method. (J.S.R.)

12882

ANGULAR AND ENERGY DISTRIBUTION OF FISSION NEUTRONS. G. A. Bat and L. P. Kudrin. J. Nuclear Energy **8**, 74-83 (1958) Nov.

The angular distribution of fission neutrons given by the statistical model of the nucleus is calculated, taking account of the angular anisotropy of emission of fission fragments. The latter is represented by the simple expression $1 + k \cos^2 \alpha$. It is assumed that the neutrons are emitted isotropically in the co-ordinate system in which the appropriate fragment is at rest. The ratio P of fission neutron intensities emitted parallel and perpendicular to the primary neutron beam is calculated for U^{238} , the energy range 1-10 Mev being covered for both primary and secondary neutrons. When the fission is considered to be induced by neutrons of the fission spectrum, the mean value of P for U^{238} comes to ~ 1.13 . The energy spectrum of the fission neutrons is also calculated for various values of the incident neutron energy. Anisotropies occurring in the fission of other nuclei may be calculated by the same method. (auth)

12883

VAN ALLEN RADIATION OF SOLAR ORIGIN. Paul J. Kellogg (Univ. of Minnesota, Minneapolis). Nature **183**, 1295-7 (1959) May 9.

Some investigators have proposed that Van Allen radiation results from the decay of neutrons produced in the earth's atmosphere by cosmic rays. There is some doubt as to whether the low-energy (< 1 Mev) radiation near the earth, due to intensity, may be attributed to this source. Other sources for Van Allen radiation are considered. A theoretical discussion is given covering several current theories. (A.C.)

12884

ON THE SECOND NEUTRAL PION. W. Królikowski

(Univ. of Warsaw). Nuclear Phys. **10**, 213-14 (1959) Mar.

The charge parity of the hypothetical second neutral pion is discussed, and a possibility of absence of strong interactions for this particle is pointed out. (auth)

12885

CHARGE SYMMETRY PROPERTIES AND REPRESENTATIONS OF THE EXTENDED LORENTZ GROUP IN THE THEORY OF ELEMENTARY PARTICLES. V. I. Ogievetsky and Chou Kuang-Chao (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Nuclear Phys. **10**, 235-43 (1959) Mar.

The extended Lorentz group, which includes the complete Lorentz group and the charge conjugation operation, is considered. It is shown that use of irreducible projective representations of the extended group requires the existence of charge multiplets. Charge symmetry and pair production of strange particles follow from invariance under reflections and charge conjugation and from the laws of conservation of electric and baryon charges. The Pauli-Gürsey transformation is valid for free nucleons. The requirement of invariance under this transformation in the case of interaction also leads to isobaric invariance for all particles in strong interactions. (auth)

12886

SCATTERING OF μ -MESONS IN LEAD. A. I. Alikhanyan (Alikhanian) and F. R. Arutyunyan (Arutyunian) (Physical Inst., Academy of Sciences, Erevan, Armenian S.S.R.). Nuclear Phys. **10**, 244-55 (1959) Mar.

Scattering of μ -mesons with momenta between 1.0 and 1.8×10^8 ev/c was studied in 7 mm lead plates. The experimental angular distribution is compared with the theoretical curve for multiple scattering which takes into account the finite dimensions of the nucleus. It is shown that after introduction of all relevant corrections the experimental data satisfactorily agree with the calculations. (auth)

12887

MEASUREMENT OF THE CIRCULAR POLARIZATION OF THE BREMSSTRAHLUNG PRODUCED BY ELECTRONS FROM ^{204}Tl . U. Amaldi, Jr. (Istituto Superiore di Sanità, Rome) and M. Bernardini, P. Brovotto, and S. Ferroni (Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) **11**, 415-23 (1959) Feb. 1.

The polarization of the external bremsstrahlung produced by the electrons emitted by Tl^{204} near the top of the spectrum (first order unique forbidden transition) was measured by means of the usual technique of the forward Compton scattering on magnetized iron. The observed effect agrees, within experimental error (about 10%), with the value expected for $-v/c$ polarized electrons. (auth)

12888

UNIVERSAL BARYON-MESON COUPLING. R. E. Behrends (Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10) **11**, 424-7 (1959) Feb. 1.

A universal baryon-meson coupling which allows for only those particles which are presently known to exist and which depends upon only one bare coupling constant is discussed. (auth)

12889

THE PRODUCTION OF CASCADE PARTICLES BY 5.5 GeV/c PIONS. W. B. Fowler, W. M. Powell, and J. I. Shonle (Univ. of California, Berkeley). Nuovo cimento (10) **11**, 428-37 (1959) Feb. 1.

The first observed production of negative cascade particles at an accelerator is reported. A 30 in. propane bubble chamber was exposed to a beam of negative pions of 5.5 Bev/c. Two cascades were identified, indicating a production cross section of $2.3_{-1.6}^{+3.1}$ μ b. The Q values found were (49.5 ± 7.9) Mev and (53.6 ± 11.3) Mev. The lifetimes were $(1.9 \pm 0.1) \cdot 10^{-10}$ s and $(5.2 \pm 0.4) \cdot 10^{-10}$ s. Both Ξ^- 's were produced backwards in the center-of-momentum system. The identification process and background is discussed. (auth)

12890

DOUBLE ELASTIC SCATTERING OF DEUTERONS IN A MAGNETIC FIELD. O. D. Chelshvili and G. R. Khutsishvili (Physical Inst., Georgian Academy of Sciences, Tiflis, U.S.S.R.). Nuovo cimento (10) **11**, 334-41(1959) Feb. 1.

Double elastic scattering of a deuteron beam in a magnetic field is considered. The expression for the angular distribution of the double elastic scattering is obtained. A discussion is given of possible experiments on deuteron double elastic scattering with and without a magnetic field. It is shown that the double elastic scattering in a magnetic field can give some additional information about the scattering amplitude and the polarization in comparison with the double scattering without a magnetic field. (auth)

12891

ABSORPTIONS OF NEGATIVE K-MESONS AT REST IN NUCLEAR EMULSION. IV. THE PION PRODUCING REACTIONS. Y. Eisenberg, W. Koch, M. Nikolić, M. Schneeberger, and H. Winzeler (Univ. of Bern). Nuovo cimento (10) **11**, 351-76(1959) Feb. 1.

Absorptions of negative K mesons at rest in nuclear emulsions were studied in great detail, using a large emulsion block. Most of the secondary particles came to rest in the stack and were identified. Comparing the results obtained in the present work with those previously obtained in a study of the interactions of fast K⁻ mesons, and with the results obtained by Alvarez et al., the following conclusions may be drawn: (1) In this experiment the single-nucleon reactions show a high rate of direct Λ -production. This result is a straightforward consequence of the observed sign fractions and absorption probabilities, if charge independence holds. It can be explained by the influence of the Fermi momentum. (2) The multi-nucleon K⁻ captures form a large fraction of the total K⁻ captures at rest. It is estimated that as much as 35 to 50% of the captures occur via the multi-nucleon channel. (3) Probably the single-nucleon K⁻ captures at rest are mainly peripheral; thus they lead, because of geometrical reasons, to smaller pion and Σ hyperon absorption probabilities. (auth)

12892

INTERACTION OF 4.5 GeV PIONS WITH EMULSION NUCLEI. A. Husain (Rajshahi Univ., Pakistan) and M. H. Siddique (Dacca Univ., Pakistan). Nuovo cimento (10) **11**, 438-9(1959) Feb. 1.

An attempt is made to plot a calibration curve for the number of shower tracks as a function of energy. The tracks of 50 stars produced by 4.5-Bev pions were analyzed and 640 prongs were found of which 77 were shower tracks. Shower tracks for 3 and 5.7 Bev pions were found to be 0.9 and 2.1 by Schein et al. These three points are plotted for a calibration curve. (W.D.M.)

12893

SYMMETRIES IN K⁻-INTERACTION. Y. Eisenberg

and W. Koch (Univ. of Bern). Nuovo cimento (10) **11**, 453-7(1959) Feb. 1.

It has been recently pointed out that the interaction of K⁻ mesons with nuclear matter could be used for checking the validity of global symmetry in strong interactions. This proposal is discussed and the two nucleon-reaction rates are calculated assuming global symmetry. (W.D.M.)

12894

A REMARK CONCERNING THE BACKWARD-FORWARD ASYMMETRY IN Λ^0 -DECAY. R. A. Salmeron and A. Zichichi (CERN, Geneva). Nuovo cimento (10) **11**, 461-5(1959) Feb. 1.

The backward-forward asymmetry in the rest frame with respect to the Λ^0 line of flight of the protons emitted in Λ^0 decay is discussed. Indications about such an asymmetry, which would show a longitudinal polarization of the Λ^0 , seem to be rather controversial. The arguments that led the authors to the conclusion that this asymmetry may be real are briefly summarized. (W.D.M.)

12895

PROTONIC DECAY OF Σ^+ HYPERON WITH ASSOCIATED ELECTRON PAIR. D. H. Davis, M. A. Shaikat, and F. R. Stannard (University Coll., London). Nuovo cimento (10) **11**, 468-9(1959) Feb. 1.

A stack of G-5 emulsion irradiated by the separated K⁻ meson beam of the Berkeley Bevatron was recently scanned and an unusual decay involving a Σ^+ hyperon was found. A star formed by the capture of a K⁻ meson at rest was seen to give rise to a single fast baryon which decayed in flight into a proton and an electron pair. The possible explanations of this event are discussed. (W.D.M.)

12896

THE CAPTURE OF NEGATIVE PIONS IN HYDROGEN AND DEUTERIUM. I. HYDROGEN. J. A. Kuehner, A. W. Merrison, and S. Tornabene (Univ. of Liverpool). Proc. Phys. Soc. (London) **73**, 545-50(1959) Apr.

A high-energy pair spectrometer was used to determine the ratio of the radiative to mesonic capture of pions stopped in liquid hydrogen. The measurement agrees well with the value expected from the charge-exchange scattering and photoproduction of pions. (auth)

12897

THE CAPTURE OF NEGATIVE PIONS IN HYDROGEN AND DEUTERIUM. II. DEUTERIUM. J. A. Kuehner, A. W. Merrison, and S. Tornabene (Univ. of Liverpool). Proc. Phys. Soc. (London) **73**, 551-5(1959) Apr.

The same apparatus described in a companion paper on hydrogen was used to study the radiative capture of pions in liquid deuterium. The result agrees well with previous measurements and the value expected from the production of pions in nucleon-nucleon collisions. (auth)

12898

INTERNAL PAIR EMISSION AT SMALL ANGLES. G. Goldring (Weizmann Inst. of Science, Rehovot, Israel). Proc. Phys. Soc. (London) **73**, 556-60(1959) Apr.

The process of electron-positron pair emission in nuclear electromagnetic transitions is investigated in the special case where the angle between the directions of emission of the electron and positron is small. It is shown that experimentally this process can be of value in determining the absolute emission rates of high energy γ rays. (auth)

12979

RESONANCE CAPTURE OF NEUTRONS IN INFINITE HOMOGENEOUS MEDIA. R. Schermer (Massachusetts Inst. of Tech., Cambridge) and N. Corngold (Brookhaven National Lab., Upton, N. Y.). Proc. Phys. Soc. (London) **73**, 561-71 (1959) Apr.

A variational principle is used together with simple but accurate trial functions to obtain expressions for (i) corrections to the commonly used "narrow resonance" formula for capture and (ii) interference effects in the capture of neutrons by closely spaced resonances. (auth)

12980

SYNTHETIC MICA AS A MONOCHROMATOR FOR LONG WAVELENGTH NEUTRONS. A. N. Goland and J. H. Sondericker, Jr. (Brookhaven National Lab., Upton, N. Y.) and J. J. Antal (Ordnance Materials Research Office, Watertown, Mass.). Rev. Sci. Instr. **30**, 269-71 (1959) Apr.

A comparison was made between natural muscovite mica and synthetic fluor-phlogopite mica with regard to their usefulness as neutron monochromators. It was found that a synthetic mica monochromator reflects a neutron beam which is from 2 to 6 times more intense than that from a natural mica monochromator, while requiring no appreciable sacrifice in resolution. The interplanar spacing of the synthetic material was found to be 9.963 Å, which is slightly larger than that of the natural mineral. (auth)

12981

THE ELASTIC SCATTERING OF SLOW ELECTRONS IN THE FIELD OF AN ATOM, APPLIED TO THE p SCATTERING OF AN ELECTRON IN THE FIELD OF ATOMIC HYDROGEN. F. B. Malik (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. **14a**, 172-93 (1959) Feb. (In German)

A method was developed to calculate the scattering of slow electrons. This method along with the well-known methods of Hulthén and Kohn are applied to calculate p-wave scattering in the normal hydrogen field. The new method avoids the ambiguity of Hulthén's quadratic equation and gives almost the same result. The interrelation of the three methods is studied and a proposal is made how one can simultaneously satisfy the conditions $L = \int \Psi (H-E) \Psi d\tau = 0$, $\partial L / \partial a = -k$, $a k = -(R_1 |U|_1)^{-1}$ appearing in the three methods. The whole theoretical discussion can, without difficulties, be extended to the modified Coulomb potential, only the regular and singular spherical Bessel functions are replaced by the regular and singular confluent hypergeometric functions of the Coulomb type, respectively. The phase shifts and the wave functions calculated without exchange agree well with the numerically solved results of Chandrasekhar and Breen. The results including exchange terms agree reasonably well with the results of the numerical integration of the Hartree-Fock equation, which has been carried out by E. Trefftz. (auth)

12982

POTASSIUM ISOTOPES AS REACTION PRODUCTS OF COSMIC RADIATION IN THE CARBO IRON METEORITE. H. Voshage and H. Hintenberger (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. **14a**, 194-5 (1959) Feb. (In German)

The potassium content of a sample from the Carbo meteorite was determined and isotopically analyzed. The K^{40}/K^{39} , K^{41}/K^{39} , and K^{40}/K^{41} ratios were measured and compared with the ratios found in normal potassium.

The results showed that all the K^{40} found and some of the K^{41} had a cosmic radiation origin. The concentration of K^{40} was larger than 7.3×10^{-11} g/g of meteorite. No evidence was found for a cosmic radiation origin of the K^{38} detected. (J.S.R.)

12983

MULTIPLE SCATTERING AND RECOIL DIFFUSION OF FAST ELECTRONS AFTER PASSAGE THROUGH THICK FOILS. H. Frank (Univ. of Göttingen, Ger.). Z. Naturforsch. **14a**, 247-61 (1959) Mar. (In German)

The angular and energy distribution of electrons scattered by metallic foils of Al, Cu, and Pb are reported. Monoenergetic electrons at 1.75 Mev were incident at various angles on the foils whose thickness gave a half-angle of at least 20° . The measurements extended to the deflection angle $\theta = 170^\circ$. In the forward direction with 90° incidence, the case of "total diffusion" was investigated, with oblique incidence the transition to symmetry about the foil plane with increasing foil thickness was studied. For back-scattered electrons the effect of the foil placement on the energy and angular distribution was investigated. The back scattering coefficients for perpendicular incidence and saturation density are 36% for Pb, 18% for Cu, and 5% for Al. Changes in the energy distribution correspond to the changes in the angular distribution with the observation geometry. (J.S.R.)

12984

GENERATION OF π^0 -MESONS IN THE INTERACTION BETWEEN ~ 9 BeV PROTONS AND NUCLEI OF THE PHOTOGRAPHIC EMULSION. G. L. Bayatyan, I. M. Gramenitskii, A. A. Nomofilov, M. I. Podgoretskii, and E. S. Skrzypczak (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. **36**, 690-3 (1959) Mar. (In Russian)

The mean energy of π^0 mesons produced in collisions between ~ 9 -Bev protons and photographic emulsion nuclei was determined. The value $\bar{E}_\pi = 750 \pm 180$ Mev was obtained for the mean π^0 meson energy. The fraction of energy carried off by π^{+0} mesons in such interactions lies between 0.33 ± 0.08 and 0.27 ± 0.07 . (auth)

12985

UNDERGROUND μ -MESON SPECTRUM AT A DEPTH OF ~ 40 m WATER EQUIVALENT. M. I. Daion and L. I. Potapov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. **36**, 697-706 (1959) Mar. (In Russian)

A magnetic spectrometer was employed to measure the momentum spectrum of μ mesons at a depth of ~ 40 mwe in the 2×10^8 to 5×10^{10} ev/c momentum range. (auth)

12986

IONIZATION ALONG THE TRACKS OF HIGH ENERGY ELECTRON-POSITRON PAIRS. A. A. Varfolomeev, R. I. Gerasimova, L. A. Makarina, A. S. Romantseva, and S. A. Chueva. Zhur. Eksptl'. i Teoret. Fiz. **36**, 707-16 (1959) Mar. (In Russian)

Experimental data are presented on the track densities of five high-energy electron-positron pairs in nuclear emulsions. The measurements were performed for the first pairs of electron-photon showers. The pair energy was estimated from the energy spectrum of the cascade electrons at a distance of 2.5 to 3 radiation lengths from the vertex of the first pair. In three cases the pair energy was close to 10^{12} ev and in two cases approximately 3×10^{11} ev. The track density was deter-

mined by two methods—from the grain density in the track and from the gap length distribution coefficient. Compared to a particle for which the specific energy loss is twice as large as the ionization loss of the electron, the track density of the pair near the vertex was found to be smaller. This decrease of the pair track density can be explained by the mutual screening of the electron and positron during ionization. The results are compared with the theoretical ionization curves for pairs calculated by Chudakov. (auth)

12907

HIGH ENERGY NEUTRONS IN COSMIC RAYS. G. N. Flerov, V. I. Kalashnikova, A. V. Podgurskaya, E. D. Vorob'ev, and G. A. Stolyarov. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 727-34(1959) Mar. (In Russian)

Multilayered ionization chambers were employed to detect the effect of heavy nuclei fission by cosmic rays. The altitude dependence of fission was investigated as well as the angular distribution of the fission producing particles. The energy and momentum of the latter were estimated. It is shown that in the overwhelming majority of cases fission of heavy nuclei is caused by the nucleon component. (auth)

12908

SCATTERING OF 590 Mev NEUTRONS BY PROTONS IN THE SMALL ANGLE REGION. B. M. Golovin, V. P. Dzhelepov, Yu. V. Katsyhev, A. D. Konin, and S. V. Medved (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 735-8 (1959) Mar. (In Russian)

The differential elastic n-p-scattering cross sections for angles from 5 to 35° in the cms was determined for 590 Mev neutrons by the ring scatterer method. A strong increase of the cross sections was found with decrease of the scattering angle. Moreover the forward scattering cross sections were found to exceed the backward cross sections. A comparison of the results obtained with predictions of the optical theorem shows that it does not seem correct to treat nucleon-nucleon scattering processes at ~600 Mev on the basis of the opaque nucleon concept. (auth)

12909

HIGH ENERGY NUCLEAR-ACTIVE COMPONENT IN EXTENSIVE AIR SHOWERS AT SEA LEVEL. A. T. Abrosimov, V. A. Dmitriev, G. V. Kulikov, E. I. Massalskii, K. I. Solov'ev, and G. B. Khristiansen (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 751-61(1959) Mar. (In Russian)

Data are presented on the number of high-energy nuclear-active particles in showers containing a total number of particles between 10^4 and 2×10^6 and also on the spatial distribution of the energy flux of the nuclear-active component. It is noted that the energy of the nuclear-active component in individual showers with an equal number of particles may widely differ. On the basis of the shape of the spectrum of the nuclear-active particles, and the shape of the spatial distribution of the energy flux of the nuclear-active component, some conclusions are drawn regarding the nature of the elementary act underlying the nuclear-cascade process. (auth)

12910

NONUNIQUENESS OF PHASE SHIFT ANALYSIS OF PROTON-PROTON COLLISIONS. V. S. Barashenkov and Huang Nen-Ning (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 832-4(1959) Mar. (In Russian)

A method based on the optical model is proposed for phase analysis of p-p collisions at energies $E \leq 10$ Bev. At energies $E \sim 1$ Bev the refractive and absorption coefficients are found to be of the same order of magnitude. The calculated differential cross sections for elastic scattering and also the total cross section and cross section for inelastic processes agree with the experiments. (auth)

12911

REACTIONS INVOLVING POLARIZED ZERO REST MASS PARTICLES. Chou Kuang-chao (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 909-18(1959) Mar. (In Russian)

The group theoretic viewpoint is employed in the present work to describe the spin states of particles possessing zero rest masses. Complete sets of operators and their eigen functions in momentum and spin representations are obtained for a two-particle system. Statistical tensors for particles produced in reactions of the $a + b \rightarrow c + d$ or $a \rightarrow c + d$ types were obtained in the case when one of the particles does not possess a rest mass. The most general selection rules for the $a + b \rightarrow c + d$ reaction are derived in the form of a relation between statistical tensors under the condition of conservation of space and time parity. The wave functions of a system consisting of two identical particles with zero rest mass are calculated. (auth)

12912

MEASUREMENTS OF MASS OF COSMIC PARTICLES UNDERGROUND. M. I. Daion and L. I. Potapov (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 921-2(1959) Mar. (In Russian)

Results are presented of particle mass measurements made with a magnetic spectrometer which simultaneously measured the pulse spectra and the positive excess of μ mesons at a depth equivalent to ~40 m of water. (R.V.J.)

12913

ON THE COVARIANT DETERMINATION OF PSEUDO-VECTOR SPIN. A. A. Sokolov, I. M. Ternov, and Yu. M. Loskutov (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 930-2(1959) Mar. (In Russian)

The longitudinal polarization of free Dirac particles is expressed by the operator $(\sigma k)/k$. This operator is an integral of motion with its own magnitude S . In addition to longitudinal polarization, an attempt is made to integrate with the value S the transverse and variant components of the spin vector. (R.V.J.)

12914

STRANGE PARTICLE PRODUCTION IN p-p COLLISIONS AT 3 Bev. V. S. Barashenkov and V. M. Maltsev (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 933-4(1959) Mar. (In Russian)

Following the analysis of previous works, it was postulated that there is no basis for considering the cross sections of strange particle production in p-p collisions much smaller than the cross sections of strange particle production in π -n collisions at equal center-of-mass systems. (R.V.J.)

12915

INTERPRETATION OF A MAXIMUM IN A TOTAL CROSS SECTION OF PROTON-PROTON SCATTERING AT 1 Bev. V. I. Rus'kin (Inst. of Nuclear Physics, Academy of Sciences, Kazakh S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 935(1959) Mar. (In Russian)

An attempt is made to explain the maximum in p-p scattering at 1 Bev as the excitation of one of the nucleons up to the isobar level. (R.V.J.)

12916

SYMMETRIC PROPERTIES IN ANTIHYPERON PRODUCTION BY ANTINUCLEON ANNIHILATION PROCESSES. Chao Kuang-chao (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 938-9(1959) Mar. (In Russian)

A mathematical analysis is made of the symmetric processes in antihyperon production by antinucleon annihilation by examining the reaction $\bar{p} + p \rightarrow \bar{\Sigma}^- + \Sigma^-$. (R.V.J.)

12917

ON THE MULTIPLE PRODUCTION OF μ MESONS. I. L. Rozental (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 943-5(1959) Mar. (In Russian)

Investigations of the high-energy ($\sim 10^{12}$ ev) shower μ meson spread curve showed a break at short distances (~ 1 to 2 m) between the two measuring counters. Various postulations are analyzed, and a preliminary conclusion is made that there must exist an additional μ meson source, in particular a direct multiple generation of μ mesons. The conclusion is not final due to the lack of precise data on high-energy μ meson showers and their electrons. (R.V.J.)

12918

ON THE MAGNITUDE OF σ^-/σ^+ RATIO NEAR THE MESON PHOTOPRODUCTION THRESHOLD. S. P. Kharlamov, M. I. Adamovich, and V. G. Larionova (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 945-7(1959) Mar. (In Russian)

The magnitude of the yield ratio of negative and positive photomesons in $\eta = N_d^-/N_d^+$ may differ considerably from the σ^-/σ^+ magnitude for the π^- -meson production on free nucleons. Also, the difference at the threshold of π^- and π^+ photoproduction in deuterium can strongly affect the magnitude η in the photon energy range near the upper boundary of the bremsstrahlung spectrum. Evaluations are made of σ^-/σ^+ considering the experimental value η , and the above effects. Measurements of the π^- and π^+ meson yield ratio from deuterium at 73° to the photon beam during irradiation by bremsstrahlung at a maximum energy $\nu = 300$ Mev and at 60° with $\nu = 165$ Mev are tabulated. The table shows that the σ^-/σ^+ ratio is approximately constant in the range 159 to 200 Mev, in good agreement with theoretical data. (R.V.J.)

12919

ON π MESON SCATTERING ON DEUTERONS. G. M. Vagrado and I. B. Sololova (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 948-9(1959) Mar. (In Russian)

An attempt was made to prove that the results of theoretical and experimental calculations of π -meson elastic scattering on deuterons would not differ in cases when the calculations are made by assuming that in the pulse approximation the nucleon mass is infinite $M \rightarrow \infty$. However, this does not hold for high energies. (R.V.J.)

12920

NUCLEUS POLARIZATION IN μ^- -MESON CAPTURE TO THE MESOATOM K SHELL. I. M. Shmushkevich (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 36, 953-4(1959) Mar. (In Russian)

In addition to depolarization of the originally polarized μ meson (in μ mesoatom formation with μ^- meson transition to the K shell) in cases where nuclei have spin I the nucleus is also polarized due to magnetic spin interactions. The mesoatom spin state can be described by a corresponding matrix ρ . Assuming that the nuclei before capture are nonpolarized, the only preferred direction is the original direction of μ meson polarization. The polarization of nuclei should be considered in experiments related to the capture of polarized μ^- mesons by nuclei, especially for determining the angular distribution of neutrons produced. (R.V.J.)

12921

NONCONSERVATION OF FIRST ORDER PARITY IN ELECTRON SCATTERING AND OTHER EFFECTS WITH WEAK INTERACTION CONSTANT. Ya. B. Zeldovich. Zhur. Eksptl'. i Teoret. Fiz. 36, 964-6(1959) Mar. (In Russian)

Heat Transfer and Fluid Flow

12922 AERE-TS/M-15

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN AIR-HEAT-TRANSFER RIG FOR TRAINING PURPOSES. H. Bowes. Feb. 1959. 24p. \$0.56(BIS).

The air heat transfer rig was built to supplement heat transfer lectures by providing an opportunity to examine the significance of certain correlations and non-dimensional relationships which, having been established for plain tubes, needed to be applied to other more complex channels. The extended use of finned surfaces swept by coolant passing along the heater rather than across, together with the importance of the pumping power factor in reactor-cycle economics, made desirable some appreciation of the over-all gain in heat transfer efficiency by employing complex can forms. In investigating these problems, a practical insight into the Reynolds number, Nusselt number, Stanton number, and Prandtl number is obtained. (J.E.D.)

12923 KAPL-M-S3G-RES-62

Knolls Atomic Power Lab., Schenectady, N. Y. REACTOR FUEL ELEMENT MATRICES WITH STRONG SECONDARY FLOWS. J. P. Fraser. Apr. 15, 1959. 49p. Contract W-31-109-Eng-52. \$7.80(ph), \$3.30(mf) OTS.

A considerable amount of heat transfer information of general interest was accumulated in the course of scoping work and analyses of possible S3G reactor core fuel elements. Analyses and tests were made on twisted oval ribbon matrix, twisted rectangular ribbon matrix, alternately crossed corrugated plates, and helical oval tube. The emphasis during this testing was on trends rather than the establishment of absolute heat transfer performance. Of particular interest was the effect of strong secondary flows on reactor core design. (W.D.M.)

12924 NP-7395

Mine Safety Appliances Co., Callery, Penna. COMPARISON OF POSSIBLE THIRD FLUIDS IN A SODIUM-WATER SYSTEM. Memo Report 70. R. C. Werner. Nov. 23, 1954. 6p. Contract NObs-65426.

A study was made of possible third fluids which may be used as a heat transfer medium and also be suitable for a leak detection system between Na and water passages. The desired properties of these fluids are listed. (W.L.H.)

12925 RDB(W)-8054

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

HEAT TRANSFER EXPERIMENTS WITH SODIUM.

W. B. Hall and A. E. Jenkins. June 1953. 19p.

The theoretical approach to the problem of heat transfer in liquid metals is briefly reviewed. The difference between this approach and that used in the case of fluids with a high Prandtl number is due to the fact that the thermal conductivity of a liquid metal may be so high as to swamp the "eddy conductivity" in a turbulent stream. A description is given of experiments in which the heat transfer coefficients between two annuli each carrying a flow of sodium were measured. Since a direct comparison with results obtained with a circular tube is not possible, the results are in quite good agreement with the theoretical values given. In the course of the work it was found that there were significant variations in temperature around the annuli carrying the liquid metal in the heat exchanger. It is thought that these variations were due to a slight eccentricity of the exchanger tubes. An approximate theoretical treatment indicates that such variations are likely to be greater (when expressed as a fraction of the over-all temperature difference) in the case of liquid metals than in the case of fluids with a high Prandtl number. In these experiments, where the heat flux was about 50 watts per cm^2 , the temperature variations were quite small, but if full advantage is taken of the liquid metal to obtain high heat fluxes, they might be so large as to produce serious thermal stresses and distortion of the heat exchanger. (auth)

12926 CEA-tr-A-452

TRANSFERT DE CHALEUR SUR UN COURANT DE POUSSIÈRES VOLANTES DANS UN TUBE VERTICAL. (Heat Transfer to a Moving Dust Stream in a Vertical Tube.) W. Brotz, J. W. Hiby, and K. G. Muller. Translated into French by R. Caboz from Chem. Ing. Tech. 30, 138-43(1958). 24p.

The transfer of heat from a wall of a heated tube to an air current containing quartzose sand was studied. The heat transfer number was measured as a function of the air velocity and of the grain charge and dimension. An interpretation of the results of the tests by the use of two simplified schemes is satisfactory. For particle diameters higher than 0.2 mm, the wall/air and air/particle heat transfers are considered as two processes in series (model with heterogeneous suspension). As a result of the calorific inertia of the particles, their radial movement does not contribute to the heat transfer. Smaller particles participate in the heat transfer because of their lower calorific inertia. In the limited case a model with quasi-homogeneous suspension is obtained. All the results are graphed with a dimensionless representation. (tr-auth)

12927

CALCULATIONS ON HEAT EXCHANGERS. I. THE 1-2 EXCHANGER. E. Slavíček (Inst. of Chemical Tech., Prague). Collection Czechoslov. Chem. Commun. 24, 839-49(1959) Mar.

Relations are derived for the calculation of the temperature distributions in a 1-2 exchanger which has differing surfaces and heat transfer coefficients in the two sections. Heat losses to the surroundings are also taken into account. (auth)

12928

ON THE HEAT CONDUCTIVITY AND SOUND ABSORPTION BY SUPERCONDUCTORS. V. T. Geilikman and

V. Z. Kresin (Moscow State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 36, 959-61(1959) Mar. (In Russian)

An attempt was made to show that the existing experimental data on the thermal conductivity of superconductors can be explained by the previously found theoretical temperature relations for electron and phonon thermal conductivity. It was also shown that the sound absorption coefficient in superconductors (at sound frequencies of $\omega \gg 1/t$ (where t is relaxation time) is the same as in any standard metal. (R.V.J.)

Nuclear Properties and Reactions

12929 WASH-1018

Nuclear Cross Section Advisory Group, AEC. REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP [MEETING AT] RICE INSTITUTE, HOUSTON, TEXAS, MARCH 4-5, 1959. V. L. Sailor. Apr. 1959. 68p. \$2.00(OTS).

Cross section measurement programs at ANL, BNL, Columbia Univ., Duke Univ., HAP0, LASL, ORNL, Phillips Petroleum Co., Rensselaer Poly. Inst., Rice Inst., and UCRL are reviewed. Informal statements of recent developments, changes in emphasis, and preliminary cross section data are included. (For preceding period see WASH-1013.) (A.C.)

12930

ON THE POSSIBILITY OF NUCLEAR CHAIN REACTIONS IN LIGHT ELEMENTS. E. Larisch and I. Shechtman. Acad. rep. populare Romine, Inst. fiz. atomica si Inst. fiz. Studii cercetari fiz. 7, 531-40 (1956) Oct.-Nov. (In Hungarian)

The possibility of a self-sustained nuclear chain reaction in a medium composed of two light elements is considered. It is assumed that only one reaction takes place in the medium and the one of the only two reaction products is a neutron. Charged particles, being in electromagnetic interaction with the medium particles, decelerate continuously and transmit only very small portions of their energy. On the other hand, neutrons, decelerating by short range collisions may transmit a great part of their energy to one particle in a media composed of light nuclei. An expression of the medium particles' current along the energy axis is given. Then, a general equation is derived for the steady state of the system in the presence of neutron external sources. The condition for the system to be "critical" is that the corresponding homogeneous equation should have a eigen-value equal to 1. The general formula is applied to the particular case when the medium is composed of deuterium and tritium in equal atomic concentrations. The calculation is based upon some simplifying assumptions. Supposing the existence of a discrete spectrum, the highest eigen-value is found to be 1.25×10^{-3} . In addition, curves are given for the neutron production density when external sources emitting neutrons at 2, 14, and 40 Mev are present. The conclusion is that such a system, maintaining a steady state without external sources, is impossible. A suggestion is proposed as to the direction where the solution to this problem might lie. (auth)

12931

THE γ EMISSION ON THE BASIS OF THE NUCLEAR SHELL MODEL. D. Bogdan and Ch. Iusim. Acad. rep. populare Romine, Inst. fiz. atomica si Inst. fiz. Studii

cercetări fiz. **7**, 541-66(1956) Oct.-Dec. (In Rumanian)

The half lives for γ radiation of the excited nuclear states are calculated, on the basis of the Tzitzzeica method for multipolar radiation. The nuclear model used was Mayer-Jensen's variant for the shell model with a potential of the form of a tridimensional isotropic oscillator. The calculations were done for transitions in which one of the states is a s state. The contribution to the radiation of the spin-orbit coupling was also evaluated. The theoretical results were compared with experimental data on the $({}_{54}\text{Xe}_{77}^{131}) s_{1/2} \rightarrow d_{3/2}$, $({}_{56}\text{Ba}_{77}^{133}) d_{3/2} \rightarrow s_{1/2}$, and $({}_{48}\text{Cd}_{63}^{111}) d_{3/2} \rightarrow s_{1/2}$ transitions. The comparison suggests the necessity of improving the model by introducing charge exchanges between the neutrons and protons constituting the nucleus. (auth)

12932

NUCLEAR ISOMERISM AND ATOMIC SPECTRA.

[PART] I. R. Weiner. Acad. rep. populare Romine, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz. **7**, 567-77(1956) Oct.-Dec. (In Rumanian)

The dependence of the nuclear charge distribution on energy gives rise to a shift of spectral lines—the nuclear isomeric shift. The calculation, based on the oscillator shell model and the perturbation method of quantum mechanics, is performed for odd-even nuclear isomers with odd number of protons in the fourth nuclear shell, and particularly for In^{116} III. A shift of $\sim 5 \times 10^{-2} \text{ cm}^{-1}$, easily measured experimentally, is found. Beside the theoretical interest, this result, together with the hyperfine-structure effect, might be a basis for a new experimental method of research and spectral analysis of nuclear isomerism. (auth)

12933

OPTICAL METHOD FOR THE DETERMINATION OF NUCLEAR SPIN AND MAGNETIC MOMENT. I. Cucu-rezeanu. Acad. rep. populare Romine, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz. **9**, 541-59 (1958). (In Rumanian)

12934

THE ACTUAL SITUATION IN THE PROBLEM OF β DECAY. [PART] I. S. Klarsfeld. Acad. rep. populare Romine, Inst. fiz. Studii cercetări fiz. **5**, 275-323(1954) July-Dec. (In Rumanian)

The history of the theory of beta decay before the appearance of the Fermi theory is given. The Fermi theory is discussed in detail with a consideration of the allowed beta transitions. Theoretical and experimental data on the shape of beta spectra for low energies and the experimental detection of the neutrino are reviewed. 112 references. (J.S.R.)

12935

MULTIPLE GENERATION OF MESONS IN THE COLLISIONS OF HIGH ENERGY PARTICLES WITH ATOMIC NUCLEI. E. Friedländer. Acad. rep. populare Romine, Inst. fiz. Studii cercetări fiz. **6**, 63-89(1955) Jan.-Mar. (In Rumanian)

On the basis of the Fermi theory of elementary reactions, a model for intranuclear cascade processes, which is connected to the interaction of a nucleon or meson of high energy ($> 10^9 \text{ ev}$) with an atomic nucleus, is studied. This model is based on the hypothesis that the life of the excited system, formed in the nucleus at the first nucleon-nucleon collision, should be comparable to the passage time of the nucleus which leads to the capture, in the system, of a number $\nu > 1$ of nucleons. From this model the multiplication is calculated as a function of ν for a given

primary energy. The angular distribution of the secondary particles was calculated in the same manner. For a energy E_0 of the incident particle (in the laboratory system) and ν captured nucleons, the multiplication varies as $\nu^{1/2} E_0^{1/4}$ and the mean angle of the shower in the laboratory system as $\nu e^{-(\alpha/\sqrt{\nu})} E_0^{-1/4}$. The comparison of the values calculated and the experimental data obtained form the study of electron-nuclear showers in the atmosphere and in nuclear emulsions shows that such a model is consistent with the existing experimental material. (tr-auth)

12936

COMPOSITION OF PRODUCTS FORMED BY THERMAL NEUTRON FISSION OF ${}^{235}\text{U}$. III. ISOTOPIC COMPOSITION AND ATOMIC WEIGHT OF THE FISSION PRODUCT ELEMENTS. Jan Prawitz (Research Inst. of National Defence, Sundbyberg, Sweden and Univ. of Stockholm). Acta Chem. Scand. **13**, 163-73(1959).

The isotopic composition and atomic weight of the fission product elements were calculated for seven different irradiation times between one day and two years, two cooling times, 100 and 3000 days, and three thermal neutron fluxes 10^{12} , 10^{13} , and $10^{14} \text{ n cm}^{-2} \text{ sec}^{-1}$. Some applications of the difference in composition between the natural and fission product elements are discussed. (auth)

12937

COMPARISON OF THE METHODS OF ADIABATIC MICROCALORIMETRY AND DIFFERENTIAL IONIZATION IN THE PRECISE MEASUREMENTS OF RADIOACTIVE PERIODS. Jean Robert. Ann. phys. **4**, 89-146 (1959) Jan.-Feb. (In French)

The measurement of radioactive periods by means of two differential ionization chambers was investigated. The design and characteristics of the ionization chambers are described in detail. The periods of Bi^{210} , P^{32} , and Be^7 were measured. A value of $T = 5.013 \pm 0.005$ days with a precision of 10^{-3} was found for Bi^{210} , in good agreement with previous results. For P^{32} , $T = 14.58 \pm 0.03$ days with a precision of 2×10^{-3} was obtained. However, because of a doubt on the purity of the phosphorus the limits or error should be $+0.03$ and -0.08 days. The period of Be^7 was measured as $T = 53.0 \pm 0.4$ days, but because of the low activity of the source the precision is only 0.75×10^{-2} . The principle of calorimetric measurements of radioactive sources is discussed as an introduction to a description of the apparatus used. The calorimeter is used in conjunction with an automatic compensator which is described in detail. The periods of Rn^{222} , Ac^{227} , and Ra^{223} were measured. For Rn^{222} a value of $T = 3.825 \pm 0.004$ days was obtained and for Ra^{223} , $T = 11.22 \pm 0.05$ days. Two samples of Ac^{227} were used and from one $T = 21.7 \pm 0.4$ years and from the other $T = 21.5 \pm 0.4$ years. A comparison of radium standards was made with the calorimeter installation, and an attempt was made to determine the period of RaD by a comparison of standards of different ages. However, the precision of the results was insufficient to give a correct value. (J.S.R.)

12938

ABSOLUTE MEASUREMENT OF β ACTIVITY. APPLICATION TO THE DETERMINATION OF THE Ra EQUIVALENT MILLIGRAM. Simone Vuccino. Ann. phys. **4**, 147-84(1959) Jan.-Feb. (In French)

A study was made of the use of β - γ and γ - γ coincidence for the absolute measurement of activities. The principles of the method of coincidences were briefly

considered, and the apparatus used was described in detail. The absolute calibration of the radioisotopes Na^{22} , Co^{60} , Sc^{46} , Na^{24} , Cu^{64} , Au^{198} , and Cs^{137} was investigated. The angular correlations between the radiations were studied, and the results are in good agreement with theory and with previous results. The results were also verified by several control methods using the 4 π counter, liquid counters, and ionization chambers. By the use of two condenser chambers filled with air or argon, the Ra equivalent milligram of several radioisotopes was determined. The results are tabulated. (J.S.R.)

12939

APPLICATION OF THE METHOD OF ANGULAR CORRELATIONS TO THE EXPERIMENTAL STUDY OF THE LEVELS OF SOME LIGHT NUCLEI. André Gallmann. *Ann. phys.* **4**, 185-238(1959) Jan.-Feb. (In French)

The theory of angular correlations of nuclear radiations is discussed for the most general case. Formulas for the case of double and triple angular correlations are derived. The complete formulas used for the calculations in the experimental investigations are given. The apparatus used is described in detail. The p- γ angular correlation in the reaction $\text{B}^{10}(\text{d},\text{p})\text{B}^{11}$ was measured, and the results are discussed. The γ - γ angular correlation for the 6.23-Mev level in the $\text{C}^{13}(\text{p},\gamma)\text{N}^{14}$ reaction at the 1.16-Mev resonance is compatible with the values $J = 1^+$ or 2^+ for the angular moment of the 6.23-Mev level of N^{14} . In the case $J = 1^+$, it is shown that the 6.23-Mev γ radiation ought to be almost pure dipolar or quadrupolar in order to satisfy the experimental results. In the case $J = 2$, only an almost pure dipolar radiation can explain the angular correlation curve found. The reaction $\text{N}^{14}(\text{p},\gamma)\text{O}^{15}$ was studied at the 1060-kev resonance. The angular distribution of the 8.34-Mev γ radiation going to the ground level of O^{15} shows that the angular moment of the 8.34-Mev level can only have the value $J = 3/2$. The γ - γ angular correlation of the cascade through the 5.27-Mev level was measured. (J.S.R.)

12940

ON THE DETERMINATION OF ABSOLUTE INTERNAL CONVERSION COEFFICIENTS BY THE COMPARISON OF CONVERSION LINES AND PHOTOLINES. AN APPLICATION TO THE 662 KEV TRANSITION IN THE DECAY OF Cs^{137} . Solve Hultberg and Rune Stockendal (Nobel Inst. of Phys., Stockholm). *Arkiv Fysik* **14**, 565-77(1959).

The method for the determination of absolute values of internal conversion coefficients by the beta-spectrometric comparison of conversion line and photoline intensities was studied. The deduction of gamma-ray intensities from measured photolines is treated and it is shown that experimentally determined photoelectric distributions can be used in the theoretical formulas to a good approximation. The instrument used is a flat double-focusing beta-ray spectrometer and general expressions are given for a source-converter assembly of cylindrical symmetry about the spectrometer axis. An application was made to the 662 kev M4 transition in Ba^{137} , and the conversion coefficient was found to be 0.093 ± 0.006 . A 2.19 ± 0.02 mg/cm² uranium converter was used. (auth)

12941

ON NUCLEAR FISSION ASYMMETRY. B. T. Geilik-

man. *Atomnaya Energ.* **6**, 290-7(1959) Mar. (In Russian)

In order to determine fission fragment mass distributions, measurements were made of the nuclear fission energy before the rupture point, considering the shell effects for several nuclei. It is shown that the minimum energy corresponds to the asymmetric fission. (R.V.J.)

12942

THE EXCITATION ENERGIES OF FISSION FRAGMENTS. B. T. Geilikman. *Atomnaya Energ.* **6**, 298-305(1959) Mar. (In Russian)

It is shown that the excitation energies of fission fragments can be found in the solution of equation systems for fragment deformation parameters and the distances between them. The initial conditions of these equations were obtained, and fragment excitation energies for several nuclei were determined. The excitation energy dependence on the Z and A of the fissioned nucleus was investigated. (tr-auth)

12943

GAMMA-GAMMA ANGULAR CORRELATIONS IN Tm^{169} . Steven D. Kočički, Jovan M. Simić, and Ante H. Kukoč. *Bull. Inst. Nuclear Sci. "Boris Kidrič"* (Belgrade) **9**, 29-37(1959).

The gamma-gamma angular correlations in Tm^{169} were measured. It was found that both K forbidden transitions of 177 and 198 kev are mixtures of M1 and E2 multipoles. The magnitudes and the interference rings of these mixtures were determined. The probabilities of partial M1 and E2 components, de-exciting the $\frac{7}{2}$ ($K = \frac{1}{2}$) particle state to the members of the $K = \frac{1}{2}$ rotational family, are given. (auth)

12944

POLARIZATION OF PROTONS FROM $\text{C}^{12}(\text{d},\text{p})\text{C}^{13}$ REACTION AS FUNCTION OF THE INCIDENT DEUTERON ENERGY. Silva D. Ćirilov and Mira K. Jurić. *Bull. Inst. Nuclear Sci. "Boris Kidrič"* (Belgrade) **9**, 39-41(1959).

Polarization of protons from the $\text{C}^{12}(\text{d},\text{p})\text{C}^{13}$ reaction was measured as a function of energy of the incident deuteron in the vicinity of the resonant energy at 1.16 Mev. It was found that the polarization varies rapidly with bombarding energy, and at the peak of the resonance the polarization is equal to zero. (auth)

12945

EXCITATION FUNCTION OF LANTHANUM FISSION PRODUCTS. A. K. Lavrukhina, L. D. Revina, and E. E. Rakovskii (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* **125**, 532-4(1959) Mar. 21. (In Russian)

An attempt is made to determine the excitation function for lanthanum fission products P^{32} , Ni^{66} , and Se^{73} at proton bombardment energies from 140 to 660 Mev. The observed activity for Se^{73} at $E_p = 140$ Mev and P^{32} at $E_p = 220$ Mev was negligibly small (~ 5 pulse/min) which permitted estimating their threshold (for Se^{73} $E_{\text{threshold}} \sim 100$ Mev and for P^{32} $E_{\text{threshold}} \sim 200$ Mev). The selected nuclei are of special interest because two of them (P^{32} and Ni^{66}) have an excess of neutrons while Se^{73} is neutron deficient. The P^{32} and Se^{73} are formed by asymmetric fission while Ni^{66} is formed by symmetric fission. The plotted curves $\sigma = f(E_p)$ have a general regularity. The cross section of fragment formation diminishes with reduced E_p . A

sharp curve rise of $\sigma = f(E_p)$ for P^{32} and Se^{73} with increase of E_p above the threshold of their formation supports the assumption on asymmetric fission of lanthanum in the range of energies studied. (R.V.J.)

12946

INTERNAL CONVERSION COEFFICIENTS FOR CERTAIN NUCLEAR TRANSITIONS IN As^{75} . A. A. Bashilov and V. V. Il'in (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 154-8 (1959) Feb. (In Russian)

Internal conversion coefficients were determined for direct nuclear transitions from the levels $E_\gamma = 265, 280, 305, \text{ and } 401 \text{ keV}$ to the As^{75} ground state. The quantum characteristics of the above levels were analyzed on the basis of the internal conversion coefficients and transitions multiplicities. It was found that transition $E_\gamma = 305 \text{ keV}$ belongs to the E3 type and $E_\gamma = 401$ to the E1 type. The level scheme and transitions are shown graphically. The ground state and levels $E^* = 280$ and 305 keV are single level while the levels with $E^* = 465$ and 401 keV are obviously configurations. (R.V.J.)

12947

DETERMINATION OF RELATIVE INTENSITIES AND COEFFICIENTS OF INTERNAL CONVERSIONS IN Se^{75} DECAY. E. P. Grigor'ev, A. V. Zolotavin, V. Ya. Klement'ev, and R. V. Sinitayn (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 159-84 (1959) Feb. (In Russian)

An analysis was made of the extensive published data on the relative γ intensities in Se^{75} decay. Experiments were carried out with a half-width line of $\sim 0.5\%$ in order to determine the K and L internal conversion lines and obtain a complete separation of photoelectron lines. A magnetic spectrometer was used with double focusing at $\pi\sqrt{2}$, half-width lines of 0.4% , and an 8-keV electron filtering membrane. The γ quanta were measured in photoelectron spectra knocked out from silver, lead, bismuth, and other elements. Twenty-six electron internal conversion spectra with 12 transitions into As^{75} were plotted. The decay scheme of $Ge^{76} \rightarrow As^{76} \leftarrow Se^{76}$ was analyzed. 55 references. (R.V.J.)

12948

INVESTIGATION OF Se^{75} SPECTRA AT 200 TO 900 KeV. N. A. Voinova, B. S. Dzelepov, and N. N. Zhukovskii (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 185-7 (1959) Feb. (In Russian)

The Se^{75} γ emission between 200 and 900 keV was studied with a magnetic spectrometer using electron recoil. A neutron-activated metallic selenium sample weighing $\sim 13 \text{ g}$ was used as the source. The initial activity of the source was $\sim 0.8 \text{ c}$. The γ energies and relative intensities obtained are tabulated and compared with published data. (R.V.J.)

12949

DECAY OF $Yb^{166} \rightarrow Tm^{166} \rightarrow Er^{166}$. E. P. Grigor'ev, B. S. Dzelepov, and A. V. Zolotavin (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 188-90 (1959) Feb. (In Russian)

Measurements were carried out on the Yb^{166} spectrum in equilibrium with the daughter product Tm^{166} and Er^{166} . In the latter, the quantity of Tm^{166} in the mixture was determined by the rising curve. The resolving power of the apparatus permitted partial separation of the $L_I + L_{II}$, L_{III} , M, and N lines of Tm^{166} and Er^{166} transitions. The corresponding conversion ener-

gies are tabulated as well as the relative intensities of $Tm^{166} + Er^{166}$ and Tm^{166} and Er^{166} in equilibrium. The transition multiplicities in even-even Er^{166} at 79.4 keV and odd-odd Tm^{166} at 81.0 keV are analyzed. The conversion intensity in Tm^{166} and Er^{166} is expressed as: $(\gamma + K + L + M + N)Tm/(\gamma + K + L + M + N)Er = 0.75 \pm 0.30$. (R.V.J.)

12950

THE Tb^{160} EMISSION. E. P. Grigor'ev, A. V. Zolotavin, and B. Kratsik (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 191-203 (1959) Feb. (In Russian)

The β spectrum and the internal and external conversion of γ transitions following Tb^{160} decay were investigated. The β spectrum was studied with fine sources, and additional data are offered on the transitions between the Dy^{160} levels which describe the complete picture of Tb^{160} decay. The decay scheme of Tb^{160} is plotted according to new and old data. The mean conversion intensities are tabulated. (R.V.J.)

12951

CONVERSION ELECTRONS OF Eu^{149} . N. A. Anton'eva, A. A. Bashilov, B. S. Dzelepov, V. V. Il'in, and B. K. Preobrazhenskii (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 204-5 (1959) Feb. (In Russian)

The conversion electron spectra of Eu^{149} γ rays at 200 to 350 keV were studied with a magnetic spectrometer. The intensity of the conversion lines was measured three times during 600 days, during which period the line intensities were conserved. The decay curve plotted according the maximum lines K-279 and K-330 show a half-life period of 100 ± 30 days, indicating the observed conversion electrons were emitted by $Eu^{149} \rightarrow Sm^{149}$ decay. Data on the decay $Eu^{149} \rightarrow Sm^{149}$ are not yet conclusive; however, it is noted that γ rays emitted in the β decay of $Eu^{149} \rightarrow Sm^{149}$ at 284 keV are probably analogous to the observed transitions of Sm^{149} at 279 keV. (R.V.J.)

12952

THE I^{131} GAMMA SPECTRUM. B. S. Dzelepov, V. P. Prikhodtseva, and Yu. V. Khol'nov (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 206 (1959) Feb. (In Russian)

The I^{131} γ spectrum at 200 to 800 keV was investigated in order to determine the relative intensities of the well known lines and to search for a 514-keV line. The results (with background deduction) were plotted. The correction for the absorption at the two extreme lines, 278 and 722 keV, differed by 7%. The special search of the 514-keV line showed that the intensity of this line should not exceed 0.4% of the line at 362 keV. (R.V.J.)

12953

THE Br^{82} γ EMISSION. B. S. Dzelepov, V. A. Eliseev, V. P. Prikhodtseva, and Yu. V. Khol'nov (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 207-10 (1959) Feb. (In Russian)

The Br^{82} spectrum was studied; ten γ lines were uncovered and the general spectrum was plotted. The energies and relative intensities of lines found by the investigation are in good agreement with published data. A clearly expressed γ line at 1648 keV was uncovered in which intensity drops with the half-life period. A clear but weak 1780-keV line was also observed. A

special search was made for γ lines at 2000 to 2700 kev. The conversion coefficients of the principle transitions were determined on the basis of the data. The Br^{80} decay scheme is analyzed. (R.V.J.)

12954

COINCIDENCES BETWEEN CONVERSION ELECTRONS IN Gd^{146} AND Gd^{151} DECAY. I. Gd¹⁴⁶ \rightarrow Eu¹⁴⁶. B. S. Dzhelepov and V. A. Sergienko (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 211-18 (1959) Feb. (In Russian)

The decay scheme of $\text{Gd}^{146} \rightarrow \text{Eu}^{146}$ ($T \sim 45$ days) was studied by means of a double-lens β spectrometer. The Gd^{146} was obtained from the deep spallation taking place during tantalum bombardment by 660-Mev protons. The neutron-deficient Gd isotopes were chromatographically separated. The sources contained Gd^{146} , Gd^{149} (9 days), Gd^{151} (150 days), Gd^{153} (236 days), Eu^{146} (4.5 days), Eu^{147} (24 days), and Eu^{149} (100 days). Gamma transitions with $h\nu = 114.8, 115.5$, and 155 kev appear in $\text{Gd}^{146} \rightarrow \text{Eu}^{146}$ decay. The electron conversion spectrum, with electron energies of ~ 150 kev measured on the half of the spectrometer facing the active side of the source, was plotted. The conversion lines of 114.8 and 115.5 kev transitions were not separated; the K line (114.8 + 115.5) had a half-width nearly equal to the single line. The line K-155 was not separated from LM (114.8 + 115.8). The transition lines with $h\nu = 21.7, 154.5, 174.8$, and 243 kev in $\text{Gd}^{151} \rightarrow \text{Eu}^{151}$ and the 69.8, 97.4, 103.3 kev transitions in $\text{Gd}^{153} \rightarrow \text{Eu}^{153}$ were not excluded. Measurements were made of coincidences between conversion electrons of the more intensive lines. The number of true coincidences was in the range of 202 to 1800 pulses/hour with a channel load $(13 \text{ to } 80) \times 10^3$ pulse/min. The ratio of the number of true to accidental coincidences was 5 : 27. The results of the experiments are plotted and analyzed. (R.V.J.)

12955

CONVERSION ELECTRON COINCIDENCES IN THE Gd^{147} AND Gd^{149} DECAY. B. S. Dzhelepov, B. K. Preobrazhenskii, and V. A. Sergienko (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 219-22 (1959) Feb. (In Russian)

A double-lens β spectrometer was used in studies of conversion electron coincidences in Gd^{147} and Gd^{149} decay. The half life of these isotopes was 1.5 and 9 days, respectively. The decay schemes are presented, and results of the experiments are analyzed. (R.V.J.)

12956

COULOMB EXCITATION OF NUCLEAR LEVELS IN SPHERICAL EVEN-EVEN NUCLEI. D. G. Alkhazov, A. P. Grinberg, K. I. Erokhina, and I. Kh. Lemberg. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 223-4 (1959) Feb. (In Russian)

Data are presented from an investigation of the Coulomb excitation first levels in Cr, Fe, Ni, Si, Zn, and Zr isotopes bombarded by three- and four-charged nitrogen ions, accelerated in cyclotron up to 15.9 to 35 Mev. Targets enriched with the investigated isotopes were used. The transition probabilities and life times of the excited nuclei are tabulated. The error for the $B(E2)$ values is of the order of 20 to 25%. (R.V.J.)

12957

EXCITED STATES OF Ga^{67} AND Ga^{69} NUCLEI. A. K. Val'ter, L. I. Zalyubovskii, A. P. Klyucharev, G. E. Krivets, and V. A. Lutsik (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). *Izvest. Akad.*

Nauk S.S.S.R., Ser. Fiz. **23**, 225-7 (1959) Feb. (In Russian)

The gamma emissions from $\text{Zn}^{66}(\text{p},\gamma)\text{Ga}^{67}$, $\text{Zn}^{67}(\text{p},\gamma)\text{Ga}^{67}$, and $\text{Zn}^{67}(\text{p},\gamma)\text{Ga}^{68}$ reactions were investigated in order to find the low-lying energy levels of Ga^{67} and Ga^{68} . Zinc targets enriched with Zn^{66} and Zn^{67} (Zn^{66} , 96.7%; Zn^{64} , 21%; Zn^{68} , 0.6%; Zn^{67} , 0.4%; Zn^{70} , <0.1% and also Zn^{67} , 71.4%; Zn^{66} , 15.5%; Zn^{68} , 8.8%; Zn^{64} , 3.5%; and Zn^{70} , 0.8%) were used. The bombarding proton energies changed within the range 1.7 to 3.4 Mev. The γ rays were recorded by scintillation spectrometer. The following lines were observed: $73 \pm 5, 170 \pm 3, 358 \pm 4, 510, 850$, and 1190 kev in the first target and $73 \pm 5, 92, 122 \pm 4, 182, 296, 358 \pm 4, 510, 1100, 1190 \pm 30, 1390 \pm 30$ kev in the second target. The low-lying energy parts of these spectra are plotted. (R.V.J.)

12958

INVESTIGATIONS OF γ RAYS PRODUCED BY PROTON BOMBARDMENT OF THE TARGET WITH Ne^{20} . A. K. Val'ter, V. Yu. Gonchar, A. N. L'vov, and S. P. Tsytko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 228-34 (1959) Feb. (In Russian)

The characteristics of the Na^{21} nucleus at the 3.57-Mev level were studied using the reaction $\text{Ne}^{20}(\text{p},\gamma)\text{Na}^{21}$. The low-lying levels of the mirror image Ne^{21} and Na^{21} nuclei were plotted on the basis of previously published data. The resonance peaks of γ -ray yields from a target containing Ne^{20} and the γ -ray resonance from $\text{F}^{19}(\text{p},\gamma)\text{O}^{16}$ reactions were correlated. Measurements of the γ spectra from the reaction $\text{Ne}^{20}(\text{p},\gamma)\text{Na}^{21}$ at 1175 kev showed only one strong γ -ray line with the energy of 3.60 Mev. Measurements of the absolute γ yield from $\text{Ne}^{20}(\text{p},\gamma)\text{Na}^{21}$ produced a value of 4×10^{-11} quanta per proton. The yield from the $\text{F}^{19}(\text{p},\gamma)\text{O}^{16}$ target was 8×10^{-11} quanta per proton, indicating the presence of fluorine in the target in quantities 10^4 times smaller than the quantity of Ne^{20} . The angular distribution of γ rays from $\text{Ne}^{20}(\text{p},\gamma)\text{Na}^{21}$ was studied, and a spin and parity of $5/2^+$ were assigned for the excited level of Na^{21} at 3.58 Mev. (R.V.J.)

12959

EFFECT OF SCREENING ON THE PROBABILITY OF EO CONVERSION ON THE K AND L SHELL AT SMALL ENERGIES. M. A. Listengarten and I. M. Band (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 235-7 (1959) Feb. (In Russian)

The electron wave functions, amplitudes a_i and a_f , and the $\Omega(k, Z)$ function for K and L shell conversion with transition energies exceeding the threshold magnitudes by 5 kev were calculated, considering the finite nuclear dimension and screening. A nuclear model of an evenly charged sphere of radius $R_0 = 1.20 A^{1/3} \times 10^{-13}$ cm and the Thomas-Fermi-Dirac statistical nuclear model were used for deriving the discrete and continuous spectra of electron wave functions. (R.V.J.)

12960

SELECTION RULES IN CONVERSION TRANSITIONS. M. E. Volkhanskii and M. A. Listengarten (Zhdanov Leningrad State Univ.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 238-43 (1959) Feb. (In Russian)

Selection rules by asymptotic quantum numbers are given for the internal nuclear conversion of the $\langle M_e \rangle$ matrix element in deformed-nuclei general transitions of arbitrary multiplicity. Also, the selection rules for

electric conversion transitions are corrected by taking into consideration the total expression for nuclear transition currents. (R.V.J.)

12961

GAMMA RAYS IN As^{78} DECAY. Yu. A. Nemilov, A. N. Pisarevskii, and L. D. Soshin (Khlopin Radium Inst., Academy of Sciences, U.S.S.R.). *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **23**, 255-6(1959) Feb. (In Russian)

As^{78} was produced by the (n,p) reactions in Se^{78} at 14 Mev. The γ spectrum was studied with a 128-channel scintillation spectrometer. Measurements were made with a single crystal spectrometer under standard conditions and an integrating spectrometer with 4π geometry. In the latter case the measured source was placed in the center of the crystal. Measurements with the single crystal spectrometer showed: γ lines at 500 keV ($T = 5$ to 6 min); γ lines at 270, 610, 800, 1280, and 2680 keV (high-intensity lines, $T = 90 \pm 10$ min); γ lines at 80, 345, 690, 1200, 1620, 1880, 2020, and 2160 (low-intensity lines, $T = 90 \pm 10$ min); and hints of the presence of a low-intensity line of ~ 2400 keV. Observations with the integrated spectrometer show three integrated lines with $T = 90 \pm 10$ min; 420, 1620, and 2700 keV. The observed lines with 90 min period should be referred to the transitions during $\text{As}^{78} \rightarrow \text{Se}^{78}$ decay. The As^{78} decay scheme is included. (R.V.J.)

12962

MEASUREMENT OF THE DIFFUSION LENGTH OF THERMAL NEUTRONS IN ICE. L. M. Barkov, V. K. Makarin, and K. N. Mukhin. *J. Nuclear Energy* **8**, 102 (1958) Nov.

The distribution of thermal neutrons from an Sb-Be source in a block of ice $100 \times 100 \times 130$ cm was measured. Measurements were made by inserting indium foils into the ice at various distances from the source. The diffusion length in ice at -14°C and 0.89 ± 0.01 g/cm³ was 2.85 ± 0.05 cm. (W.D.M.)

12963

K-CAPTURE TO POSITON [POSITRON] BRANCHING RATIOS IN THE DECAY OF Ga^{68} . M. K. Ramaswamy (Johns Hopkins Univ., Baltimore). *Nuclear Phys.* **10**, 205-12(1959) Mar.

K-capture to positron branching ratios were measured in the decay of Ga^{68} using coincidence scintillation spectrometer techniques. The measured values are 1.28 ± 0.12 (to the first excited state) and 0.10 ± 0.02 (to the ground state). Assuming these decays to be pure Gamow-Teller transitions, the Fierz interference terms are computed to be $b_{GT} = -0.03 \pm 0.02$ and $+0.03 \pm 0.01$, respectively (the uncertainty in the latter result arising from uncertainty in N_0 , the source strength). The ratio of positrons to the first excited state and ground state of Zn^{68} was found to be $(1.76 \pm 0.22) \times 10^{-2}$. A search for a possible low-lying 0^+ state in Ga^{68} was made through the decay of Ge^{68} using x-ray-x-ray and x-ray- γ -ray coincidences employing NaI(Tl) crystals. Besides the 9 keV K x ray, annihilation radiation and the known γ ray in Ga^{68} whose energy was measured to be 1.067 ± 0.035 Mev, no other γ ray was observed ($<8\%$ of 1.07γ). The number of positrons per 1.07γ quantum was determined as 19.47 ± 2.10 by comparison with Na^{22} . An upper limit of 0.4% per decay was set on positron emission by Ge^{68} . (auth)

12964

SPIN AND PARITY OF THE 760 keV RESONANCE LEVEL IN THE REACTION $\text{Si}^{30}(\text{p}, \gamma)\text{P}^{31}$ AND OF THE INTERMEDIATE LEVELS IN P^{31} . Lennart Simons

(Univ. of Helsinki). *Nuclear Phys.* **10**, 215-19(1959) Mar.

Certain triple angular correlation functions are calculated and compared with the results of triple angular correlation measurements for the reaction $\text{Si}^{30}(\text{p}, \gamma)\text{P}^{31}$. Spin $\frac{1}{2}$ and even parity for the 760 keV resonance level, spin $\frac{1}{2}^+$ for the 3.51 Mev level, and $\frac{5}{2}^+$ for the 2.23 Mev level are obtained. (auth)

12965

INTERNAL CONVERSION OF GAMMA-RAY TRANSITIONS IN As^{76} . F. R. Metzger and W. B. Todd (Franklin Inst., Swarthmore, Penna.). *Nuclear Phys.* **10**, 220-5(1959) Mar.

The internal K-conversion coefficients of the 136-, 265-, 280-, 305-, and 402-keV transitions in As^{76} were measured using a lens spectrometer and scintillation counters. The E1 character of the 136- and 402-keV transitions was confirmed, and the E3 assignment to the 305-keV gamma ray was clearly established. For the 265- and 280-keV E2 + M1 transitions, mixing parameters $\delta_{265} = -0.06 \pm 0.04$ and $\delta_{280} = -0.42 \pm 0.05$ were obtained on the basis of all the presently available information. The M1 transition probability of the 265-keV transition is at least one order of magnitude larger than that of the 280-keV transition while the E2 transition probabilities appear to be comparable. The spin and parity assignments made by Schardt were confirmed. (auth)

12966

CROSS SECTIONS FOR SOME (n, p) AND (n, α) REACTIONS. B. D. Kern, W. E. Thompson, and J. M. Ferguson (Naval Radiological Defense Lab., San Francisco). *Nuclear Phys.* **10**, 226-34(1959) Mar.

The cross sections for the $\text{Mg}^{24}(\text{n}, \text{p})\text{Na}^{24}$, $\text{Al}^{27}(\text{n}, \alpha)\text{Na}^{24}$, $\text{Si}^{28}(\text{n}, \text{p})\text{Al}^{28}$, $\text{Cr}^{52}(\text{n}, \text{p})\text{V}^{52}$, and $\text{Fe}^{56}(\text{n}, \text{p})\text{Mn}^{56}$ reactions were measured for neutrons produced by the $\text{H}^3(\text{d}, \text{n})\text{He}^4$ reaction. The activation method was used, with the gamma rays which are emitted following beta decay being counted with a NaI(Tl) scintillation crystal. The $\text{Mg}^{24}(\text{n}, \text{p})\text{Na}^{24}$ cross section was found to be 219 ± 26 mb at 13.0 Mev. The $\text{Al}^{27}(\text{n}, \alpha)\text{Na}^{24}$ cross section varies smoothly from 139 mb at 13.0 Mev to 106 mb at 15.7 Mev. The $\text{Si}^{28}(\text{n}, \text{p})\text{Al}^{28}$ cross section changes smoothly from 370 mb at 12.3 Mev to 160 mb at 18.3 Mev, with a broad peak at 13.5 Mev with the maximum value of 380 mb. The $\text{Cr}^{52}(\text{n}, \text{p})\text{V}^{52}$ cross section decreases slowly from 125 mb at 12.3 Mev to 72 mb at 18.3 Mev. The $\text{Fe}^{56}(\text{n}, \text{p})\text{Mn}^{56}$ cross section is found to be 131 ± 15 mb at 15.3 Mev. The results are generally in agreement in those cases where previous results of others exist. (auth)

12967

OBSERVATION OF THE BREMSSTRAHLUNG OF π -MESONS INTERACTING WITH NUCLEI. M. F. Lomanov, A. G. Meshkovskii (Meshkovsky), Ya. Ya. Shalamov, V. A. Shebanov, and A. F. Grashin (Academy of Sciences, Moscow). *Nuclear Phys.* **10**, 283-93(1959) Mar.

Nuclear force bremsstrahlung of π^+ mesons was observed in a freon bubble chamber in which 80 to 300 Mev π^+ mesons interacted with carbon, fluorine, and chlorine nuclei. In the indicated energy range the bremsstrahlung cross section for inelastically and elastically scattered π^+ mesons as derived from 20 scattering events was found to be $(4.5^{+1.2}_{-1.0}) \times 10^{-27}$ cm² per fluorine nucleus. Three cases of bremsstrahlung involved absorption of the π^+ -mesons by the nucleus;

in two cases of bremsstrahlung charge-exchange scattering of π^+ -mesons on the nucleus occurred. The bremsstrahlung cross sections for these various types of nuclear processes were computed in the quasiclassical approximation. The values obtained from the formulas satisfactorily agree with the experimental results. (auth)

12968

INELASTIC SCATTERING FROM SEPARATED LUTECIUM ISOTOPES. B. Elbek, M. C. Olesen, and O. Skilbreid (Univ. of Copenhagen). *Nuclear Phys.* **10**, 294-305(1959) Mar.

Lutetium targets of high isotopic purity were prepared in an electromagnetic isotope separator. In order to obtain thin deposits of the target material on fragile backings, a method was developed where the ions after the separation are strongly retarded by an electrical potential on the collector. Targets prepared in this way were used to study the Coulomb excitation of the rare odd isotope Lu^{176} and of the abundant isotope Lu^{175} by observation of inelastically scattered protons and deuterons in a magnetic spectrometer. The measured excitation energies and transition probabilities in Lu^{176} are in good agreement with the predictions of the rotational model if the ground state spin of this isotope is 7. (auth)

12969

SIZE AND SHAPE OF THE ATOMIC NUCLEUS. Hans Kopfermann (Univ. of Heidelberg, Ger.). *Strahlen-therapie* **108**, 489-506(1959) Apr. (In German)

To-day it is possible to determine the shape of the nuclei of atoms despite their mininity at a fair accuracy by means of free or bound leptons, which are electrons and μ mesons. It was found that all nuclei, protons, and neutrons as well, have a finite dimension. The radius of the nucleus increases proportional to the cubic root of the number of parts of the nucleus, in agreement with theoretical considerations. Only a few nuclei have spheric arrangement of their charge. Most of them are rotation symmetrical. The deviation from a sphere is generally little. In some parts of the periodic system, e.g., among the rare earths, considerable deformations are present with elongation of the shape of the nucleus in the direction of the rotational axis of the nucleus. Independent of their spheric or rotation symmetrical shape the nuclei have a border area in which the charge of the spheric nuclei decreases rapidly, the charge of the rotation symmetrical nuclei decreases slowly towards zero. (auth)

12970

ON THE THINNING DOWN OF TRACKS OF HEAVY NUCLEI IN NUCLEAR EMULSIONS. P. G. Bizzeti and M. Della Corte (Istituto Nazionale di Fisica Nucleare, Florence and Istituto di Fisica dell'Universita, Arcetri, Florence). *Nuovo cimento* (10) **11**, 317-33(1959) Feb. 1.

Photometric measurements of track widths were carried out in the thin-down region on C^{12} and O^{16} tracks and also on tracks of α and singly charged particles stopping in the emulsion. An appropriate model for the process of track formation in the thin-down region is proposed, and successfully tested on the experimental material. (auth)

12971

THE $^{36}\text{Cl}(\gamma, n)^{34}\text{Cl}$ AND $^{35}\text{Cl}(\gamma, n)^{34}\text{Cl}^m$ REACTIONS INVESTIGATED UP TO 31 Mev. F. Ferrero, S. Ferroni, R. Malvano, S. Menardi, and E. Silva (Univ. of Turin

and Istituto Nazionale di Fisica Nucleare, Turin).

Nuovo cimento (10) **11**, 410-14(1959) Feb 1.

Measurements were made of photoneutron cross sections for activation of the 1.58 s ground state and of the 32 min isomeric state in Cl^{34} . The branching ratio is found to be of the order of unity. A tentative explanation of the peculiar behavior of the b.r. in the region of the giant resonance is given. (auth)

12972

STATISTICAL ERRORS IN DELAYED COINCIDENCE MEASUREMENTS. A. E. Blaugrund (Weizmann Inst. of Science, Rehovoth, Israel). *Physica* **25**, 185-9(1959) Mar.

The statistical error in measurements of life times of excited states of nuclei is calculated. Conditions for minimum error in a delayed coincidence experiment conducted within a fixed time T are computed. The effect of random coincidences on the statistical error and on the optimal counting conditions is considered. The results are represented graphically. (auth)

12973

THE BETA RAYS OF PRASEODYMIUM-144 AND THE AXIAL VECTOR BETA INTERACTION. N. J. Freeman (Bedford Coll., London). *Proc. Phys. Soc. (London)* **73**, 600-8(1959) Apr.

The shapes, intensities, and end-points of the three strong components of the Pr^{144} beta spectrum were measured with a prolate spheroidal field spectrometer and coincidence techniques. A spin of 0- was assigned to the ground state of Pr^{144} on the basis of these measurements. It is shown that the pure axial vector correction factor for a $\Delta I = 0$ (yes) transition provides a good fit to the ground state spectrum. The spectrum of the β transition to the 695 kev level in Nd^{144} has a unique first-forbidden shape. (auth)

12974

THE $^{39}\text{K}(d, p)^{40}\text{K}$ REACTION. A. W. Dalton, G. Parry, and H. D. Scott (Univ. of Liverpool). *Proc. Phys. Soc. (London)* **73**, 677-81(1959) Apr.

The investigation was made using 8.9-Mev deuterons. Protons were investigated from levels up to an excitation of 5.34 Mev, and angular distribution measurements were made on a number of groups. The energy spectrum of protons emitted at 15° is shown. Excitation energies corresponding to the observed proton groups are tabulated. (A.C.)

12975

THE ELECTRON, POSITRON, AND GAMMA SPECTRUM OF Cu^{64} . Wolf-Dieter Schmidt-Ott (Univ. of Göttingen, Ger.). *Z. Physik* **154**, 286-93(1959). (In German)

With a scintillation spectrometer, the β^- and β^+ spectra of Cu^{64} ($T_{1/2} = 12.8$ hr) were investigated. The preparation was in an anthracene split crystal which was placed in a NaI crystal. In coincidence with the annihilation radiation which was detected in the NaI crystal, the positrons were measured and the electrons were measured in anticoincidence. The permitted spectra with the total energy $E_{\beta^-} = 580 \pm 17$ kev and $E_{\beta^+} = 665 \pm 20$ kev were obtained. A linear relationship exists between the light yield in anthracene and the particle energy for positrons from 150 to 665 kev. The light yield for 665-kev electrons and positrons is the same. The gamma radiation of Cu^{64} was also investigated. The energy was determined to be $E_\gamma = 1.317 \pm 0.008$ Mev and the intensity was $N_\gamma/N_{\beta^+} = 0.0280 \pm 0.0024$. (tr-auth)

12976

MEASUREMENT AND ANALYSIS OF THE ANGULAR DISTRIBUTION AND EFFECTIVE CROSS SECTION OF THE $F^{19}(p, \alpha_0)O^{16}$ REACTION IN THE ENERGY RANGE 0.4 TO 0.72 Mev. G. Breuer (Physikalischen Staatsinstitut, Hamburg). Z. Physik **154**, 339-51(1959). (In German)

Total and differential cross sections from $F^{19}(p, \alpha_0)O^{16}$ were studied at effective proton energies of 0.485, 0.55, 0.60, 0.64, 0.676, and 0.72 Mev. In this energy range the angular distribution shows a pronounced energy dependence. An analysis of the results has made it possible to determine the state of the known resonance at 0.72 Mev. Moreover, the existence of some weak broad resonances below 0.7 Mev could be gathered from the angular distribution. This is in agreement with earlier considerations made by Gerjuoy. (auth)

12977

POLARIZATION-CORRELATION MEASUREMENTS ON Na^{24} . Th. Mayer-Kuckuk and R. Nierhaus (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Z. Physik **154**, 383-8(1959). (In German)

An arrangement for the measurement of angular correlations between β particles and circular polarized γ radiation is described, and a result on Na^{24} is given. A correlation coefficient $A = (+0.12 \pm 0.03)$ was obtained, which indicates a ratio of Gamow-Teller to Fermi matrix element $M_G/M_F > 10$. (auth)

12978

THE ISOMERISM OF $^{172}Hf^{179}$. K.-W. Hoffmann, I. Y. Krause, W.-D. Schmidt-Ott, and A. Flammersfeld (Univ. of Göttingen, Ger.). Z. Physik **154**, 408-18(1959). (In German)

The gamma and conversion electron spectra of the 19-sec Hf isomer were measured with scintillation spectrometers in a 4π geometry. The half life was measured as $T_{1/2} = 18.6 \pm 0.2$ sec. From the spectra, the conversion coefficients for both transitions could be determined. For the 161-kev transition a total conversion coefficient $\alpha_{161} = 35 \pm 2$ and a K conversion coefficient $\alpha_{K,161} = 19.4 \pm 1.2$ were found, which agree well with the factors calculated for an M3 transition. The measurements gave $E_2 = 217 \pm 2$ kev for the energy of the second transition and $\alpha_{217} = 0.055 \pm 0.010$ for the total conversion coefficient. In contrast to earlier hypothesis, it is clear that it is a matter of E1 radiation in this transition. Spin and parity of the ground state and the excited states of Hf^{179} are in agreement with the level sequence given by Nilsson for deformed nuclei. (tr-auth)

12979

RESULTS OF LOW TEMPERATURE RESEARCH. XXIII. ATOMIC AND ELECTRON HEAT OF MOLYBDENUM AND TUNGSTEN BETWEEN 10°K AND 273°K. Klaus Clusius and Paolo Franzosini (Univ. of Zurich). Z. Naturforsch. **14a**, 99-105(1959) Feb. (In German)

The atomic and electron heat of molybdenum and tungsten was measured between 10 and 273°K on two compact samples which had a purity of 99.99%. The recent results of various investigators agree well with each other. The standard entropy at 25°C was 6.83 clausius for molybdenum and 7.83 clausius for tungsten. The gamma value for the temperature-proportional electron heat varied little from the helium range up to room temperature:

| | below 15°K | | over 100°K | |
|------------|---------------------------|--------------|---------------------------|------------|
| | $10^4 \gamma$ in cal/deg. | Θ_g^* | $10^4 \gamma$ in cal/deg. | Θ_g |
| Molybdenum | 5.0 0.5 | 454° | 6.5 | 383° |
| Tungsten | 2.7 | 380° | 4.9 | 320° |

The Debye Θ value exhibits, over 100°K, the decrease characteristic for the transition metals, when the determination is made directly from the observed C_v values. A constant Θ_g value for the lattice was obtained between 100°K and room temperature, when the electron heat was not considered. These Θ_g values in both elements are 84.3% of the Θ_g^* values valid in the T³ range. (tr-auth)

12980

NATURAL RADIOACTIVITY OF GADOLINIUM-152 AND HAFNIUM-174. W. Riezler and G. Kauw (Univ. of Bonn). Z. Naturforsch. **14a**, 196(1959) Feb. (In German)

The alpha decay of Gd^{152} was studied with the nuclear emulsion technique using samples enriched in the 152 isotope. The tracks and their range gave a decay constant of $\lambda = 7.3 \times 10^{-16}$ per year and a half life $T = 9.5 \times 10^{14}$ year. Enriched samples of Hf^{174} were also studied. The decay constant was $\lambda = 1.6 \times 10^{-16}$ per year and the half life was $T = 4.3 \times 10^{15}$ year. (J.S.R.)

12981

PHOTOFISSION OF Li^6 NUCLEI. F. Däublin, F. Berthold, and P. Jensen (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. **14a**, 208-11(1959) Mar. (In German)

The cross section of the $Li^6(\gamma, d)He^4$ reaction was determined with a proportional counter to be $7.3 \times 10^{-31} \text{ cm}^2 \pm 75\%$ at a quantum energy of 2.20 Mev and $2.5 \times 10^{-32} \text{ cm}^2 \pm 50\%$ at 2.76 Mev. The radiation width of the 2.188-Mev state of Li^6 was calculated as 3×10^{-6} ev and was compared with the results of a single particle model and with intermediate coupling calculations. (tr-auth)

12982

DEFORMATION AND QUADRUPOLE MOMENTS OF LIGHT NUCLEI. Elmer Windthorst (Univ. of Munich). Z. Naturforsch. **14a**, 294-305(1959) Mar. (In German)

An investigation was made to determine to what extent a nonspherical nuclei structure could be explained in the shell model with deformable oscillation potential with consideration of nucleon-nucleon interaction and configuration mixtures. Deformations which lie in the range expected from quadrupole moment measurements appeared in the nuclei Li^6 , Li^7 , Be^9 , and N^{14} . An improvement of the value of the quadrupole moments over earlier calculations was obtained. (tr-auth)

12983

PECULIARITIES OF BI FISSION AT VERY HIGH EXCITATION ENERGIES. V. F. Darovskikh and N. A. Perfilov (Radium Inst., Academy of Sciences, U.S.S.R.). Zhur. Ekspitl. i Teoret. Fiz. **36**, 652-7(1959) Mar. (In Russian)

Nuclear emulsions were used to study the relative yields from Bi fission induced by 660-Mev protons. The dependence on the ratio of the ranges of light and heavy fission fragments, l_π/l_T , for various nuclear groups involving different excitation energies was also considered. The dependence of the fission yields on the range ratio was not found to vary consistently for some nuclei. The dependence of the mean total range of the fragments on l_π/l_T was obtained. An explanation of the

experimental facts is suggested on the basis of the shell structure of the product nuclei. (auth)

12984

ENERGY—RANGE RELATION OF 660 Mev PROTONS. V. P. Zrelov and G. D. Stoletov (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 658-68(1959) Mar. (In Russian)

The mean range of protons in copper was determined by the slowing down method. The proton energy was computed from the measured angle of emission of Vavilov—Cherenkov radiation by protons in plexiglas. With account of relevant corrections the range of (658 ± 2) Mev protons in copper was found to equal (257.6 ± 1.2) g/cm². Assuming the ionization potential to be independent of the velocity, the calculated value of I_{Cu} is found to be (305 ± 10) ev. The stopping power with respect to copper was also measured for H, Be, C, Fe, Cd, and W. (auth)

12985

EXACT MEASUREMENT OF THE RATIOS OF THE INTERNAL CONVERSION COEFFICIENTS FOR 411.8 kev γ -QUANTA IN Hg¹⁹⁸. V. M. Kelman and R. Ya. Metskhvarishvili (Leningrad Inst. of Physics and Tech.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 694-6(1959) Mar. (In Russian)

The following internal conversion coefficient ratios were obtained for 411.8 kev γ rays in the shells and subshells of Hg¹⁹⁸: $K/L = 2.69 \pm 0.02$; $L_I:L_{II}:L_{III} = 1:(1.05 \pm 0.02):(0.45 \pm 0.01)$; $L:M:N:O = 1:(0.252 \pm 0.004):(0.077 \pm 0.004):(0.018 \pm 0.002)$. Within the accuracy of the measurements the experimental ratios agree with theoretical values presented in the tables of Sliv and Band. (auth)

12986

RATIO OF DEUTERON TO PROTON YIELD IN THE PHOTODISINTEGRATION OF Au¹⁹⁷. E. D. Makhnovskii (Leningrad Inst. of Physics and Tech.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 739-43(1959) Mar. (In Russian)

The ratio of the photodeuteron yield to the photo-proton yield was measured for gold irradiated with 70 Mev maximum energy bremsstrahlung. The ratio was found to equal 0.14 ± 0.07 . The protons and deuterons were identified by grain counting over the last 90 μ of the particle range in the emulsion. (auth)

12987

FISSION OF NUCLEI OF HEAVY ELEMENTS PRODUCED BY IMPINGING CARBON, NITROGEN AND OXYGEN NUCLEI. S. M. Polikanov and V. A. Druin. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 744-7(1959) Mar. (In Russian)

The energy dependences of the cross sections for Bi and U fission induced by accelerated C¹², N¹⁴, and O¹⁶ nuclei and also the dependences of the Au, Re, and Yb fission cross sections on the N¹⁴ ion energy are presented. The measurements were performed with an ionization chamber and monochromatic beam from a 150-cm cyclotron. Experimental results pertaining to the measurement of the ranges and angular anisotropy of the U²³⁸ and Au fission fragments produced by accelerated C¹² ions are also presented. (auth)

12988

TWO-NEUTRON CAPTURE REACTION IN THE INTERACTION BETWEEN N¹⁴ AND NUCLEI OF SOME ELEMENTS. V. A. Karnaukhov, G. M. Ter-Akopyan, and V. I. Khalizev. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 748-50(1959) Mar. (In Russian)

Targets of LiF, Al, and Cu were irradiated with

~ 92 Mev N¹⁴ ions. Among the reaction products the radioactive isotope N¹⁶ was detected on the basis of its decay period and β -particle energy. It is concluded that N¹⁶ is formed as a result of the two-neutron capture from the target. (auth)

12989

THE CROSS SECTIONS FOR CALIFORNIUM ISOTOPE PRODUCTION BY IRRADIATING U²³⁸ WITH ACCELERATED CARBON IONS. V. V. Volkov, L. I. Guseva, A. S. Pasyuk, N. I. Tarantin, and K. V. Filippova. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 762-5(1959) Mar. (In Russian)

The energy dependence of the reactions U²³⁸(C¹⁴, 4n-5n)Cf²⁴⁶⁻²⁴⁸ and U²³⁸(C¹³, 5n-6n)Cf²⁴⁶⁻²⁴⁸ was investigated. Stacks of foils and radiochemical analysis of the reaction products were employed. The results obtained indicate that the investigated reactions involve the formation of a compound nucleus with subsequent evaporation of the neutrons. The reaction cross sections are employed to estimate the competition between neutron evaporation from the compound nucleus and fission. (auth)

12990

ON FISSION OF NONSPHERICAL NUCLEI. A. G. Sitenko (Khar'kov State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 793-7(1959) Mar. (In Russian)

Direct fission of a nonspherical nucleus arising as a result of the transfer of a large angular momentum to the nucleus by the absorbed particle is considered. (auth)

12991

QUADRUPOLE OSCILLATIONS OF DEFORMED NUCLEI. B. L. Birbrair, L. K. Peker, and L. A. Sliv (Leningrad Inst. of Physics and Tech.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 803-9(1959) Mar. (In Russian)

Formulas are derived for quadrupole oscillations of deformed nuclei. The interaction between the rotation and vibrations is considered and a general formula is given for the corrections for the level energy of the ground rotational band. Presently available experimental data for nuclei in the rare earth region are discussed and the difficulties encountered in their analysis are mentioned. (auth)

12992

ON THE ROLE OF EXCHANGE EFFECTS IN STRIPPING REACTIONS. V. G. Neudachin, I. B. Teplov, and O. P. Shevchenko (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 36, 850-3(1959) Mar. (In Russian)

A general expression was obtained for the cross section for heavy particle stripping as one of the exchange effects in stripping theory. Some results of numerical computations of exchange effects in stripping reactions are presented for some of the simplest cases. (auth)

12993

ON THE THEORY OF NUCLEAR MAGNETIC MOMENTS. D. F. Zaretskii. *Zhur. Eksptl'. i Teoret. Fiz.* 36, 869-73(1959) Mar. (In Russian)

Due to a strong spin-orbit coupling an additional interaction between nucleons in the nucleus and the electromagnetic field arises. The effect of this additional factor on nuclear magnetic moments is considered for spherical as well as nonspherical nuclei. It is shown, in particular, that about half of the anomalous deviation of the magnetic moment of Bi²⁰⁹ from the Schmidt line may be due to this effect. (auth)

12994

ELECTROMAGNETIC RADII OF THE LIGHTEST NUCLEI IN THE GROUND AND LOWEST EXCITED STATES. A. K. Kaminskii and Yu. M. Shirokov (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 874-8(1959) Mar. (In Russian)

The radii of nuclei with mass numbers 5 to 8 are calculated for the ground and excited states from experimental data on isotopic multiplets and scattering of high energy electrons on nuclei. It is shown that, excluding the He^5 - Li^5 doublet, the radii monotonously increase with the energy for all nuclei. One of the levels of Be^8 is identified with greater precision. (auth)

12995

ON THE STABILITY OF NUCLEI. P. E. Nemirovskii. *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 889-95(1959) Mar. (In Russian)

The dependence of the interaction between a nucleon and the nucleus on N/Z was investigated. An estimation of the maximal A/Z is given; this ratio is found to vary between 3 and 3.8. It is shown that when N equals the number of neutrons in a closed shell the minimal Z discontinuously changes by several units. It is suggested that these jumps in the values of Z_{\min} upon closure of the neutron shell may be responsible for the considerable abundance of certain isotopes, providing that the synthesis of atomic nuclei occurred in brief neutron bursts. (auth)

12996

ON THE ANGULAR ANISOTROPY OF FRAGMENT SEPARATION IN Am^{241} FISSION BY 14.7 Mev NEUTRONS. A. N. Protopopov, I. A. Baranov, and V. P. Eismont. *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 920-1(1959) Mar. (In Russian)

The relative number of fragments distributed in the parallel and perpendicular direction to the dropping neutrons was found, and the degree of Am^{241} angular anisotropy, considering the center mass motion, angular resolution end effect, and the background of scattered neutrons was determined to be 1.08 ± 0.06 . (R.V.J.)

12997

NUCLEAR EXCITATION INDUCED BY HIGH-ENERGY PARTICLES. M. Z. Maksimov. *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 922-4(1959) Mar. (In Russian)

A method is suggested for calculating the dependence of \bar{N} (the mean number of nucleons knocked out in fast particle interactions with nuclei) and \bar{U} (the mean excitation energy of the residual nucleus) on the energy E_0 and mass number A . (R.V.J.)

12998

THE α DECAY OF Th^{227} ACCORDING TO THE COLLECTIVE MODEL AND Ra^{223} SPIN AT THE LOWER STATE. S. G. Ryzhanov. *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 928-30(1959) Mar. (In Russian)

Previous communications indicated that the relative intensities of the Th^{227} α group, produced by decay from the ground level to Ra^{223} , are about the same, ~ 17 to 21%. Hence, such levels should be considered as ground levels for three spinning series. The spin of the low level Ra^{223} is determined in order to find the probability of mother-nucleus α decay of spin I_0 . It is found that the ground level spin of the mother nucleus (Th^{227}) is $I_0 = 7/2$ or $9/2$ and the lower level spin of Ra^{223} is $I_0 = 3/2$ or $5/2$. (R.V.J.)

12999

ON THE DISORDERED FREE PRECESSION IN ATOMIC

NUCLEUS MAGNETIC MOMENTS. G. V. Skrotskii and A. A. Koldin (Ural Polytechnic Inst.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 932-3(1959) Mar. (In Russian)

The signal of disordered free precession in nuclear magnetic moments was separated from the thermal noise spectra. The relation η in the resonance is proportional to $(\gamma H_0)^2$. The latter condition can be used as the basis for spin generator self-excitation theory. (R.V.J.)

13000

RANGE-ENERGY RELATION OF C^{12} , N^{14} , AND O^{16} IN ALUMINUM, COPPER, AND GOLD AT 50 TO 110 Mev. Yu. Ts. Oganesyan. *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 936-7(1959) Mar. (In Russian)

Studies were made of the relations between nuclear reaction induced by multicharged ions and the data on the range-energy relation of heavy ions in various materials. Experiments were made for the direct determination of these relations for carbon, nitrogen, and oxygen ions in aluminum, copper, and gold. The $(\text{C}^{12})^{4+}$, $(\text{N}^{14})^{5+}$, $(\text{O}^{16})^{6+}$, and $(\text{O}^{16})^{4+}$ ions were accelerated in a 150-cm cyclotron with a beam removing magnet focusing a narrow deuterium beam into a specially protected cabin 12 m from the cyclotron. The above type of beam removing system was used for producing sufficiently intense beams. The range-energy relation data for C^{12} , N^{14} , and O^{16} in aluminum, copper, and gold are plotted and tabulated. The data are in good agreement with Papino's semiempirical calculations and are somewhat below the N and O ion curves in photoemulsion at 0 to 130 Mev, previously reported by D. M. Parfanovich et al. (*JETP* **33**, 343(1957)). (R.V.J.)

13001

GAMMA RAYS FROM As^{74} . Yu. E. Loginov and K. I. Yakovlev (Radium Inst., Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 940(1959) Mar. (In Russian)

The γ spectrum of As^{74} was studied with a single-channel scintillation spectrometer operating with NaI(Ta) crystal and photomultiplier FEU-S. The efficiency of the spectrometer was checked with standards with known decays. The lines, energies, and relative intensities found were compared with previously published data. The existence of 1190 and 2220 kev lines was confirmed; however, the 960 and 1600 kev lines require further investigation. (R.V.J.)

13002

NEW SHORT LIVED ISOMERS As^{76m} AND Ga^{76m} PRODUCED IN FAST PROTON REACTIONS. A. M. Morozov and P. Ya. Yampol'skii (Inst. of Chemical Physics, Academy of Sciences, U.S.S.R.). *Zhur. Eksptl'. i Teoret. Fiz.* **36**, 950-1(1959) Mar. (In Russian)

Experiments were carried out in order to determine the properties of As^{76m} produced by irradiation of germanium by fast protons. Using Ge enriched to 7.67% Ge^{76} , it was confirmed that Ge^{76} is responsible for the reaction producing the short-life isomer. A very intense short-life radiation with $E_\gamma = 0.29 \pm 0.01$ Mev and $T_{1/2} = 16 \pm 1$ msec was found. The threshold of reaction was ~ 13 Mev. The data obtained are in good agreement with previously reported data on As^{76m} ($E_\gamma = 0.305$ Mev, $T_{1/2} = 17$ msec) which was produced by the E2 transition from the 402-kev level. However, it is shown that As^{76m} is also produced in As^{76} proton reactions. The short-lived isomer ($E_\gamma = 0.19 \pm 0.01$ Mev and $T_{1/2} = 19 \pm 1$ msec) produced by fast proton bombardment of gal-

lium is also analyzed. The results show that Ga^{70m} produced by the reaction $\text{Ga}^{71}(p,pn)\text{Ga}^{70m}$ is responsible for the $E_\gamma = 0.19$ level. (R.V.J.)

13003

GAMMA RAYS IN U^{238} FISSION BY 2.8 AND 14.7 Mev NEUTRONS. A. N. Protopopov and B. M. Shiryayev (Radium Inst., Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. **36**, 954-5 (1959) Mar. (In Russian)

The energies of γ rays emitted in U^{238} fission by fast neutrons was determined by comparison with the γ spectra from U^{235} thermal fission. The γ quanta were recorded by a scintillation counter with NaI(Tl) crystal working in coincidence with a single-layer dividing chamber for fission recordings. Targets of U^{235} and U^{238} , similar in diameter to the mean density of 1.8 and 2.2 mg/cm^2 , respectively, were used. The amplitude distributions of γ quantum pulses in U^{235} fission by thermal neutrons and U^{238} fission by 2.8 and 14.7 Mev fast neutrons are plotted. The data show that the mean total γ -ray energy for U^{238} fission by fast neutrons is identical, within 15%, to that of U^{235} fission by thermal neutrons. Also, it was found that the mean γ quantum energy value per fission event for U^{235} , U^{238} , and Cf^{252} is very similar and that the γ quantum energy does not depend on the excitation energy of the compound nucleus before the fission. (R.V.J.)

13004

ANGULAR DISTRIBUTION ANISOTROPY OF FISSION FRAGMENTS IN ROTATING NUCLEUS. G. A. Pik-Pichak. Zhur. Eksptl'. i Teoret. Fiz. **36**, 961-2 (1959) Mar. (In Russian)

The anisotropy dependence was determined with considerations for neutron evaporations. (R.V.J.)

Theory

13005 CERN-59-17

European Organization for Nuclear Research, Geneva. NOTES ON QUATERNION QUANTUM MECHANICS. PART III. David Finkelstein, J. M. Jauch, and David Speiser. Apr. 1959. 30p.

The correspondence between the techniques of Fock spaces in quantum mechanics and the techniques of the functional calculus in logic is discussed. Ways to go from two distinct theories of one individual each to one theory of a system of two distinct individuals are considered. (W.D.M.)

13006 ISC-1136

Ames Lab., Ames, Iowa. ELECTROMAGNETIC FIELD ANALOGY FOR NEUTRON DIFFUSION THEORY. James Russell Melcher and Glenn Murphy. Nov. 1958. 90p. Contract W-7405-eng-82. \$15.30(ph), \$5.40(mf) OTS.

It is shown that an analogy exists between the neutron flux as predicted by single-group neutron diffusion theory and the axial component of the electric field intensity in a field excited as a plane transverse-magnetic wave. The analogy is shown to be restricted to core regions of right-cylindrical geometry containing homogeneous mixtures of moderator and fuel. Two types of devices from which measurements may be taken are described and their limitations are determined. A section of wave guide excited below cutoff is used to take measurements analogous to those taken from a subcritical pile of infinite height. These measurements are

shown to provide the buckling of a core of arbitrary cross-section by measuring an intensity distribution and the frequency of excitation. The use of a cavity was found to be superior, since it provided the buckling by measuring only the frequency. Experimental techniques are described for measuring control rod worth for fully extended cylindrical control rods of arbitrary cross section, and illustrative solutions are given for the cruciform and eccentric rods in a circular bare core. A method is described for predicting the flux distribution in the core region, and experimental results are shown for the circular core with and without control rods and a core of equilateral triangular cross-section. The theoretical flux distribution in an equilateral triangular core is derived for correlation with this experiment. (auth)

13007 NP-7350

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

CONSERVATION OF COMBINED PARITY AS FUNDAMENTAL LAW OF THE SYMMETRY IN NATURE. V. G. Soloviev. 1958. 8p.

The fundamental principle of the unified theory of relativity reflecting the properties of space-time is stated in the following postulate: physical laws must be invariant with respect to the proper Lorentz transformations. The requirements of invariance with respect to inversion of space-time coordinates reflect the properties of space-time. The restrictions which are imposed for the field theory by the general properties of space-time must be common for various forms of interactions. The various theoretical treatments of parity conservation in both weak and strong interactions are reviewed and compared with experimental observations. (A.C.)

13008 NP-7444

California. Univ., Los Angeles.

NUCLEAR FORCES AND THE PROPERTIES OF NUCLEAR MATTER. Technical Report No. 2. S. A. Moszkowski. Apr. 1959. Contract DA-04-495-ORD-913.

The application of the Brueckner theory to the nuclear many-body problem can be greatly simplified if one separates the actual two nucleon interaction into a short range and a long range part. The dividing line between the two is chosen in such a way that the short range part alone gives no phase shift, even when the exclusion principle is neglected. The long range part of the potential is then essentially the desired kind of "effective interaction" for shell model calculations. The dividing line depends to some extent on the relative momentum of the two-particle system. This leads directly to a weakening of the effective interaction with increasing relative momentum. Because of the velocity dependence of the one-particle average potential, the effective interaction decreases as the nuclear density increases. This procedure appears to provide a simple way for understanding the observed saturation properties of nuclear matter, and also of the relative smallness of configuration interaction in the nuclear shell model. (auth)

13009

CHARACTERISTIC FREQUENCIES OF THE COMPRESSIBLE NUCLEUS IN AN NON-STATIC STATISTICAL MODEL. I. Brândus and A. Săndulescu. Acad. rep. populare Romîne, Inst. fiz. atomică si Inst. fiz. Studii cercetări fiz. **8**, 433-44 (1957). (In Rumanian)

Characteristic frequencies of the compressible nu-

cleus are calculated by dynamizing its statistical model as was done by Bloch (*Z. Physik* 96, 431(1935)) in an analogous way, for the statistical model of the atom. For this purpose, it is assumed that the excitation energy of the nucleus does not give rise to thermal movements but leads to an ordered movement that can be treated in a hydrodynamical manner. The effect of this movement is the perturbation of the mass density of the excited nucleus. When the action integral, with an advisable Lagrangian—assuming the ratio of neutrons and protons to be constant in the nucleus—is a minimum, one obtains the equation for the density perturbation term. In a search for the monochromatic oscillations, their characteristic frequencies are determined from the boundary condition at the nucleus surface of the equilibrium between the inner pressure of the nuclear fluid and the one created by the surface tension. The results agree qualitatively with experimental data. (auth)

13010

EXPRESSION OF THE GENERAL SOLUTION OF THE STATIC PROBLEM OF THE THEORY OF ELASTICITY FOR AN ISOTROPIC BODY BY APPLYING PLANE HARMONIC FUNCTIONS. V. I. Blokh. *Dopovidi Akad. Nauk Ukr. R.S.R.* No. 11, 1172-6(1958). (In Russian)

Expressions are given for the displacement vector and the stress tensor in an elastic isotropic body for a three-dimensional space with complex ors on the plane by applying independent functions of a complex variable on this plane. (auth)

13011

SURFACE CORRECTIONS TO THE FERMI-THOMAS STATISTICAL THEORY. M. A. Naqvi (Univ. of Manchester, Eng.). *Nuclear Phys.* 10, 256-82(1959) Mar.

The Hartree-Fock equations are written in matrix form with the aid of the Dirac density matrix. The Fermi-Thomas theory is generalized so that these equations are explicitly satisfied for the diagonal elements and those lying near the diagonal. This procedure modifies the functional relationship between the energy and particle densities by introducing a dependence of the former on the derivatives of the particle density and on the nature of the collective field. It is shown by a simple example that the modifications appear to bring the statistical theory into better agreement with the empirically known results for the case of a local average field. They also provide a method of estimating the effects of the non-locality of the average field on the surface characteristics of a many-body system. (auth)

13012

HOLES IN THE 1p SHELL IN THE UNIFIED MODEL. C. S. Warke (Tata Inst. of Fundamental Research, Bombay) and G. Abraham (Atomic Energy Establishment, Trombay, India). *Nuclear Phys.* 10, 306-10 (1959) Mar.

The negative parity levels in nuclei of mass number $A = 13, 17, 19$ are derived on the basis of a hole in the $1p_{3/2}$ or $1p_{1/2}$ shells weakly coupled to the surface oscillations. (auth)

13013

IRREDUCIBILITY CONSTRAINTS AND FIELD EQUATIONS FOR THE ELEMENTARY PARTICLES. I. BOSONS. C. G. Bollini (Comisión Nacional de la Energía Atómica, Buenos Aires). *Nuovo cimento* (10) 11, 342-50(1959) Feb. 1.

The conditions needed to describe an elementary particle by an irreducible quantity in the Lorentz

group, are taken as constraint equations to be imposed on the field entity. The independent components are extracted in a covariant way. The field equations are deduced from a Lagrangian in which only the free components are permitted to be varied. The commutation relations, compatible with the constraints, are also given. (auth)

13014

HYDRODYNAMICAL MODEL AND INELASTICITY IN MULTIPLE PRODUCTION OF PARTICLES. C. Iso (Kyoto Univ.) and M. Namiki (Waseda Univ., Tokyo). *Nuovo cimento* (10) 11, 440-2(1959) Feb. 1.

A possible hydrodynamical description of expanding meson-nucleon clouds in the framework of quantum field theory was previously presented in which it was shown that such a description is useful if the relaxation time of the cloud is very short compared with its diffusion time. In the present note, it is shown that one may calculate the inelasticity and obtain its values consistent with the experimental ones, under the assumption that the clouds can be represented by the model of a mixed fluid with two constituents, the meson- and nucleon-fluids, and that the front part of the fluid is mainly occupied by the nucleon constituent at the end of the expansion. (W.D.M.)

13015

NON-LOCAL INTERACTION AND UNIVERSAL CUTOFF. E. Arnous (Centre National de Recherche Scientifique, Paris) and W. Heitler (Universität, Zurich). *Nuovo cimento* (10) 11, 443-6(1959) Feb. 1.

Considerable evidence has accumulated in recent years to show that the present field theories with local interaction have only a limited field of validity which can be expressed by a certain cutoff in momentum space. Such a cutoff is formulated in terms of a non-local interaction with a form factor specified to a large extent. This form factor is discussed in coordinate space. (W.D.M.)

13016

MULTIPLE SCATTERING CORRECTIONS IN π -DEUTERON SCATTERING. V. De Alfaro (Univ. of Turin and Istituto Nazionale di Fisica Nucleare, Turin) and R. Stroppolini (Univ. of Naples and C.N.R.N., Naples). *Nuovo cimento* (10) 11, 447-52(1959) Feb. 1.

An evaluation of the multiple scattering corrections to the impulse approximation for π -d scattering was previously published. The problem is reconsidered by making use of a π -nucleon scattering matrix with a high momenta behavior such that the propagator does not have singularities at small distance. (W.D.M.)

13017

THE THEORY OF INTERNAL FIELD EMISSION. Josef Kamphusmann (Univ. of Münster, Ger.). *Z. Naturforsch.* 14a, 165-71(1959) Feb. (In German)

In the quantum mechanical treatment of the internal field emission, the potential part $eF \cdot r$ of the electrical field F perturbs the periodicity of the Schroedinger equation. Therefore, an infinite fundamental region must be selected in order to solve the equation by a development of Houston functions. In the present work it is shown how this condition can be improved. Instead of the Houston functions wave packets from the Bloch functions are taken to a finite fundamental region which moves as a whole according to the classical acceleration equations for the pulse through the wave calculation space so that it is possible to eliminate the non-periodical potential part $eF \cdot r$. Determinant wave func-

tions for the many electron problems were established. It is therefore shown that in this approximation the internal field emission is a single electron process. As one passes again to an infinite fundamental region, the Houston theory is obtained. (tr-auth)

13018

THE RADIAL SYMMETRICAL SOLUTION FOR SCALAR MASSLESS MESONS IN THE PROJECTIVE RELATIVITY THEORY. Joachim Petzold (Free Univ. of Berlin). *Z. Naturforsch.* 14a, 205-7 (1959) Mar. (In German)

The complete radial symmetrical static solution of the field equations for scalar massless mesons in the projective relativity theory was given and discussed. There is no singularity-free solution. (tr-auth)

RADIATION EFFECTS ON MATERIALS

13019 AERE-I/M-45

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A LITERATURE SURVEY OF THE EFFECTS OF HIGH ENERGY RADIATION ON VARIOUS PLASTICS. P. R. Sewell. July 1957. 39p.

A literature survey of the effects of radiation on various plastics was prepared from about three hundred unclassified papers and reports. (J.E.D.)

13020 AERE-R/M-169

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

STORED ENERGY IN BEPO GRAPHITE. G. H. Kinchin. Feb. 1958. Decl. Apr. 30, 1959. 54p.

The results of a detailed survey of stored energy in BEPO graphite are described. Most of the measurements were of the adiabatic rise type, with corrections applied for any departures from adiabatic conditions. Stored energy was measured along the length of a number of normal fuel channels, and subsidiary measurements indicated the variation of stored energy between channels. Channels with abnormal cooling were investigated; parts of the reactor unaffected by the 1954 energy release were found. Data relevant to the initiation of a reactor energy release are presented. (auth)

13021 HW-59300 A

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NEUTRON DAMAGE TO METALS—A PROGRAM DOCUMENT. A. A. Bement, D. L. Gray, and R. L. Hales. Mar. 1, 1959. 62p. Contract W-31-109-Eng-52. \$1.75(OTS).

A program to determine the effects of neutron irradiation on Cu, Ni, Fe, Mo, Ti, Zr, and 347 stainless steel is described. The methods of determining reaction kinetics and activation energies of recovery are described. The over-all testing program is divided into irradiation measurements and post-irradiation recovery studies. The types of property changes due to neutron irradiation were observed, as well as effects of total exposure, irradiation temperature, and metal structure on the amount of damage sustained. Determination of the mechanisms of recovery will be conducted at HAPO. The metals are to be exposed to five neutron levels, and four or more properties will be investigated over a series of isochronal and isothermal annealing treatments. The

properties to be investigated include micro-hardness, electrical resistance, and lattice parameter. A schedule of specimen allocation is presented. Also included are descriptions of the major facilities to be used on the program such as annealing facility, electrical resistance apparatus, tensile instrument, and miscellaneous testing equipment. In addition, a list of documents pertaining to the program is listed. (J.R.D.)

13022 NP-7509

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST 22 [ON RADIATION EFFECTS DATA]. Apr. 15, 1959. 44p. Project No. 2133. Contract AF33(616)-5171.

13023 REIC-Memo-14

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON ELECTRICAL INSULATING MATERIALS. J. W. Moody. Mar. 31, 1959. 11p. Project No. 2133. Contract AF33(616)-5171.

Except for glass, the inorganic materials used as insulators are much more radiation resistant than are organic polymers. Damage in ceramic substances arises from atomic displacements and is manifested as changes in the lattice parameters, strength, electrical properties and dimensions. Most ceramic materials are able to withstand integrated fast neutron fluxes of 10^{22} neutron cm^{-2} before they become unsatisfactory as insulators. The radiation damage suffered by ceramic insulators may be annealed at elevated temperatures. Both types of material, organic and inorganic, show strong photoconductive effects when placed in a radiation field. The increased current leakage resulting from this effect may constitute a problem for certain applications of insulators. (auth)

13024 REIC-Memo-15

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON HOSES AND COUPLINGS. M. C. Schroeder. Mar. 31, 1959. 5p. Project No. 2133. Contract AF33(616)-5171.

Standard aircraft hoses and couplings contain organic polymeric materials which are affected significantly by nuclear radiation. To determine the functional life of these items when exposed to radiation, tests were conducted at controlled conditions of temperature, pressure, type of internal fluid, and radiation-exposure rate. Buna N, a solvent-resistant synthetic rubber, and Teflon, a temperature-resistant plastic, were the hose materials for most of the tests. These hoses were irradiated by gamma rays at conditions simulating actual operation for a specified time or until leakage occurred. Buna N hose withstood exposure dosages up to 4×10^5 ergs $\text{g}^{-1}(\text{C})$ before leaking, compared with 1×10^5 ergs $\text{g}^{-1}(\text{C})$ for Teflon hose, both at static pressures of 1200 psig and temperatures up to 350°F. The exposure dose required for failure of Teflon hose by intermittent pressure (0 to 1000 psig) was about 1×10^5 ergs $\text{g}^{-1}(\text{C})$ at 350°F. (auth)

13025 SCR-75

Sandia Corp., Albuquerque, N. Mex.

RADIATION-INDUCED EFFECTS AT HIGH DOSES AND APPLICATIONS TO REACTOR GAMMA DOSIMETRY. W. H. Cropper and A. W. Snyder. Apr. 1959. 15p. Contract [AT(29-1)-789]. \$3.30(ph), \$2.40(mf) OTS.

Presented at Sixth Tripartite Instrumentation Conference, Chalk River, Canada, April 1959.

The measurement of absorbed "integrated" gamma dose in a reactor field presents abundance of complex problems. Several aspects of what seems to be the most immediate of these problems are presented. (W.L.H.)

13026 SCR-76

Sandia Corp., Albuquerque, N. Mex.

RADIATION EFFECTS TESTING AT THE LOS ALAMOS GODIVA II A FACILITY. L. J. Zipprich, comp. Apr. 1959. 20p. \$0.75(OTS).

Revision of an Informal Memorandum "Godiva II—Its Availability and Suitability for Radiation Effects Tests." W. J. Buckalew, comp.

The Los Alamos Scientific Lab., recognizing the unique nuclear environment offered by Godiva II radiation bursts, has agreed to make this facility available without charge to DOD contractors on a general schedule of 2 days each month for the performance of qualified radiation effects tests. The procedure for reserving time and space at the facility is outlined. A brief description of the facility is given. (W.D.M.)

13027

EFFECT OF X- AND ULTRA-VIOLET IRRADIATION ON THE INCORPORATION OF PHOSPHORUS-32 INTO ISOLATED NUCLEI OF RABBIT APPENDIX. Yuong-Tchel Tchoe and A. Sibatani (Yamaguti Medical School, Ube, Japan). *Nature* 183, 1334-5(1959) May 9.

In previous studies it was observed that the removal of desoxyribonucleic acid from rabbit appendix nuclei isolated in sucrose severely impairs the incorporation of phosphorus-32 into desoxyribonucleic acid, ribonucleic acid, and organic acid-soluble phosphate. The lost capacity for incorporation can be restored by the addition of some polyanionic compounds, such as calf thymus desoxyribonucleate, yeast ribonucleate, or chondroitin sulfate. By treating the nuclei with pancreatic desoxyribonuclease in the presence of chondroitin sulfate, the bulk of desoxyribonucleic acid may be removed from the nucleus without appreciably affecting its capacity for incorporation. The effect of treatment with pancreatic desoxyribonuclease in the presence of chondroitin sulfate on the capacity of phosphorus-32 uptake of isolated nuclei is tabulated. (A.C.)

13028

CHANGE OF THE ELECTRON STRUCTURE OF ALUMINUM BY α IRRADIATION. W. Kapp and F. Stangler (Univ. of Vienna). *Z. Physik* 154, 486-94(1959). (In German)

The electrical conductivity of aluminum is decreased by corpuscular irradiation. By use of the formula given in the electron theory of metals for a model with two energy bands, it is possible to calculate the number and mobilities of electrons and holes and their partial conductivity from the Hall constant of a magnetic field H , the Hall constant for $H = 0$, and the electrical conductivity. The changes produced by corpuscular radiation in metals are subject to very rapid increases at room temperatures. Therefore the irradiation as well as the measurement of the Hall constant and conductivity must be made in a low temperature bath. The experimental arrangement for such measurements was described. Po^{210} was used as the alpha source. After a 90 hour irradiation the Hall constant decreased about 0.9% and the electrical conductivity about 5.3%. The conductivity decrease of the aluminum by alpha irradiation was ex-

plained in a large part by the decrease in electron mobility and in a small measure by the decrease in the number of holes: (tr-auth)

13029

INFRARED EXTINCTION OF THE PHOTOCONDUCTIVITY OF CdS CRYSTALS IN PRIMARY EXCITATION WITH X RADIATION. H. Thiel (Deutschen Akademie der Wissenschaften, Berlin). p.50-6 in "Festkörperphysik und Physik der Leuchtstoffe. Tagung der Physikalischen Gesellschaft in der Deutschen Demokratischen Republik, Vom 20. -24. Oktober 1957, in Erfurt. (Solid State Physics and the Physics of Luminiscent Material. Session of the Physics Society in the German Democratic Republic from Oct. 20 to Oct. 24, 1957, in Erfurt.)" Berlin (East), Akademie-Verlag, 1958. 322p.

The extinction of the x-radiation induced photoelectric conductivity of CdS crystals by infrared light was investigated to establish whether extinction maxima produced in high-energy excitation were different from those produced in optical excitation. The crystals used were pure and contained no activators. The comparative effects of air and vacuum on the extinction curves and the effects of the thermal treatment of the crystals was investigated. The time dependence of the extinction curve was also established. (J.S.R.)

13030

PHOTOCONDUCTIVITY EXCITATION OF CdS SINGLE CRYSTALS BY GAMMA RAYS. E. Schnürer (Deutschen Akademie der Wissenschaften, Berlin). p.44-9 in "Festkörperphysik und Physik der Leuchtstoffe. Tagung der Physikalischen Gesellschaft in der Deutschen Demokratischen Republik, Vom 20. -24. Oktober 1957, in Erfurt. (Solid State Physics and the Physics of Luminiscent Material. Session of the Physics Society in the German Democratic Republic from Oct. 20 to Oct. 24, 1957, in Erfurt.)" Berlin (East), Akademie-Verlag, 1958. 322p.

The relative photosensitivities of CdS crystals in light, x-ray, and gamma excitation were compared. The dependence of the photoelectric current on the voltage and intensity of the gamma irradiation, as well as the photoelectric current behavior in supplementary gamma or light excitation, was obtained. The pulse-height distribution occurring in the connection of the cells as crystal counters was studied. (tr-auth)

13031

PHOTOCHEMICAL BEHAVIOR OF SOME SENSITIZED SILVER HALOGENIDE CRYSTALS UNDER X IRRADIATION. E. Jeltsch (Deutsche Akademie der Wissenschaften, Berlin). p.23-6 of "Festkörperphysik und Physik der Leuchtstoffe. Tagung der Physikalischen Gesellschaft in der Deutschen Demokratischen Republik, Vom 20. -24. Oktober 1957 in Erfurt. (Solid State Physics and the Physics of Luminiscent Material. Session of the Physics Society in the German Democratic Republic from Oct. 20 to Oct. 24, 1957, in Erfurt.)" Berlin (East), Akademie-Verlag, 1958. 322p.

Some results on the x irradiation of AgCl and AgBr crystals, sensitized with Ag_2Se or Ag_2S , at temperatures around -180°C are reported. The effects of irradiation duration and temperature on the absorption spectrum were investigated. A simple model to explain the experimental results is presented. (J.S.R.)

RADIOACTIVE WASTE

13032 AECU-4102

Johns Hopkins Univ., Baltimore.
FEASIBILITY OF ESTABLISHING A NATIONAL BURIAL GROUND FOR RADIOACTIVE WASTE IN THE NORTHEASTERN UNITED STATES. James M. Morgan, Jr. July 15, 1956. 126p., 1 illus. Contract AT(30-1)-1477. \$21.30(ph), \$6.90(mf) OTS.

A search was made within a 125-mile radius of Erie, Pennsylvania, to discover a possible site for a national land burial ground to receive and bury low and intermediate level radioactively contaminated waste. The new burial facility would serve a sixteen state section of the northeastern United States. Estimated unit burial costs and computed transportation charges indicate that a centrally located site within the section is both feasible and desirable. It will be necessary to make complete geologic, hydrologic, and radiologic investigations at any site selected as a burial ground. (auth)

13033 HW-41440

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

RECOMMENDED LIMIT FOR RADIOACTIVE LIQUID DISPOSAL FROM HANFORD SEPARATIONS PLANTS TO SURFACE PONDS. H. V. Clukey. Feb. 16, 1956. 5p. \$1.80(ph), \$1.80(mf) OTS.

A control limit for the activity density of radioactive materials which may be permitted in large-volume waste waters discharged from the Hanford separations plants to open ponds is set forth. The limit 5×10^{-5} microcuries of beta emitters per cc of waste solution was recommended for use in operational control, at the same time providing a criterion for in-line monitoring facilities and alternate routing facilities for the time that the activity density exceeds control limit. (J.R.D.)

13034 HW-51026

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

LEAK DETECTION—UNDERGROUND STORAGE TANKS. W. A. Haney. June 20, 1957. 7p. Contract [W-31-109-Eng-52]. \$1.80(ph), \$1.80(mf) OTS.

Data are presented relating to the establishment of a leak detection system for radioactive waste storage tanks. The precision of the liquid level measurement for detecting a significant leak and the time interval desirable between measurements for active and static tanks were determined. The limits of predicted percolation rates through the soil, channeling of streams, etc. from a leaking tank and of escaping vapors from active tanks were established. Location of electrodes in the soil in the vicinity of the tank farms to best detect a leak was made. (J.E.D.)

13035 HW-53219

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

EVALUATION OF SITES FOR THE DISPOSAL OF RADIOACTIVE WASTE SOLUTIONS. J. R. McHenry and J. F. Honstead. Nov. 15, 1957. 12p. Contract W-31-109-Eng-52. \$3.30(ph), \$2.40(mf) OTS.

The depth of soil profile above the water table, the average exchange capacity, and the capacity factor of the effective soil profile are presented for the Separations areas and surrounding area in the three contour maps. The area immediately southeast of 200-West area is found to have the greatest capacity factor. Greater volumes of radioactive liquids can be disposed

of here per unit surface area than at other sites studied within current disposal limits. Because the soil profiles are also deepest in this same general area, disposal by specific retention of liquid would be most practical in this area. The soil characteristics associated with 200-East Area sites are generally less suitable for waste disposal than those of sites in the 200-West Area. Immediately south of the 200-East Area, however, the soil conditions are considered better for the disposal of radioactive liquids. The relative utility of the various sites for disposal of radioactive solutions is based on an evaluation of the soil properties only. (auth)

13036 HW-59298

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

PLUTONIUM RECYCLE TEST REACTOR LIQUID AND GASEOUS WASTE DISPOSAL. J. E. Hard and D. R. Koberg. Feb. 17, 1959. 10p. Contract [W-31-109-Eng-52]. \$3.30(ph), \$2.40(mf) OTS.

For normal operation adequate instrumentation has been incorporated to detect off standard conditions and initiate corrective action. Additional instrumentation for the routine measurement of radioactive materials released to the atmosphere and the river was given serious consideration. A careful evaluation which is summarized leads to the conclusion that additional instrumentation is not warranted for the process waste systems. In this conclusion it is recognized that heat exchangers can fail and radioactivity may be released to the river. As additional experimental facilities are added to the PRTR, the waste disposal program will be reviewed and changes made to maintain adequate control on radioactive materials released to environs. (auth)

13037 TID-7517(Pt. II)(Del.)

Division of Reactor Development, AEC and Public
Health Service, Washington, D. C.

SANITARY ENGINEERING ASPECTS OF THE ATOMIC ENERGY INDUSTRY. A SEMINAR SPONSORED BY THE AEC AND THE PUBLIC HEALTH SERVICE HELD AT THE ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO, DECEMBER 6-9, 1955. Oct. 1956. Decl. with deletions Apr. 7, 1959. 28p. \$4.80(ph), \$2.70(mf) OTS.

Two papers are presented from the seminar. Separate abstracts have been prepared for each paper. (W.L.H.)

13038 TID-7517(Pt. II)(Del.)(p.5-22)

General Electric Co., Schenectady, N. Y.
OPERATIONAL EXPERIENCE IN HANFORD LIQUID WASTE DISPOSAL. D. W. Rhodes, J. R. Raymond, and H. V. Clukey. p.5-22 [of] SANITARY ENGINEERING ASPECTS OF THE ATOMIC ENERGY INDUSTRY. A SEMINAR SPONSORED BY THE AEC AND THE PUBLIC HEALTH SERVICE HELD AT THE ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO, DECEMBER 6-9, 1955. 16p.

The operational experience with ground disposal of low level radioactive liquid wastes at Hanford has been generally favorable over a period of approximately 10 years. Disposal units are placed underground to avoid radiation and contamination hazards and the liquid wastes are allowed to percolate through at least 200 feet of sediments which adsorb the long-lived radioisotopes. In more recent years, the application of laboratory findings and field observations together with chemical scavenging to reduce the concentrations of Cs¹³⁷ and Sr⁹⁰ has resulted in the disposal of other wastes con-

taining 1 to 50 $\mu\text{C}/\text{ml}$ of total beta-emitters and 0.02 $\mu\text{C}/\text{ml}$ of both Cs^{137} and Sr^{90} . Continual observation of the location and movement of the radioisotopes discharged to ground has been maintained by routine sampling of monitoring wells extending to ground water in the near vicinity of the disposal sites. No ground water contamination of objectionable concentrations has resulted from ground disposal. (auth)

13039 TID-7517(Pt. II)(Del.)(p.23-36)

General Electric Co. [Hanford Atomic Products Operation], Richland, Wash.

FLOW PATTERNS IN DISPOSAL TO THE COLUMBIA RIVER. J. W. Healy, J. F. Honstead, and W. Y. Matsumoto. p.23-36 [of] SANITARY ENGINEERING ASPECTS OF THE ATOMIC ENERGY INDUSTRY. A SEMINAR SPONSORED BY THE AEC AND THE PUBLIC HEALTH SERVICE HELD AT THE ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO, DECEMBER 6-9, 1955. 9p.

Cooling water from Hanford reactors when returned to the Columbia River contains small amounts of radioactive material, mainly comprised of short-lived isotopes. Monitoring of effluent is carried out to confirm the safe disposal of effluent to the river. Measurements of the rate of diffusion of the reactor effluent in the river permit estimates of the degree of dilution at downstream pumping stations. A possible method of reducing the concentration of short-lived isotopes in the effluent by directing it through a system of inland lakes has been studied. (auth)

13040

STORAGE OF ATOMIC WASTES IN GLACIAL CAPS OF THE EARTH. Bernhard Philberth. Compt. rend. **248**, 2090-2(1959) Apr. 6. (In French)

On a glacial surface of 10^5 km^2 , the wastes of atomic plants in which the useful power is 10^8 kw can be deposited for 100 years. Greenland alone is sufficient. However, Antarctica has glacial expanses $>10^7 \text{ km}^2$. The quantity of heat released by the wastes could be decreased by storing the wastes prior to release in the ice caps. This would give a reserve of ≈ 2 orders of magnitude. (tr-auth)

13041

SOME EXPERIMENTS ON THE DECONTAMINATION OF LIQUID WASTE CONTAINING RADIOACTIVE STRONTIUM. CHEMICAL TREATMENT WITH A LABORATORY SCALE PLANT. E. Cerrai, A. Scaroni, and C. Triulzi (CISE, Milan). Energia nucleare (Milan) **6**, 207-17(1959) Mar.

A laboratory scale plant was studied for decontamination of liquid waste containing radiostrontium. Preliminary experiments were carried out on a bench scale to determine the best operating conditions. (auth)

13042

CERAMIC SPONGES FOR RADIOACTIVE WASTE DISPOSAL. C. W. Christenson (Los Alamos Scientific Lab., N. Mex.). J. Am. Water Works Assoc. **51**, 388 (1959) Mar.

Porous clay bodies for radioactive waste disposal were investigated. Preliminary results indicate that some ceramics absorb from 50 to 200% of their weight. Ceramic sponges which had absorbed Sr-90 and Cs-137 were fired to 1300°C with subsequent water leaching. No appreciable radioactivity was found in the leach solutions. Since the method has shown promise, a full-scale investigation is planned. (J.R.D.)

13043

RADIOACTIVE WASTE DISCHARGES FROM NUCLEAR REACTORS. James G. Terrill, Jr. (Public Health Service, Washington, D. C.). Sewage and Ind. Wastes **30**, 270-82(1958) Mar.

Many types and quantities of radioactive material are potential wastes. These must be considered in terms of such groupings as sources, activity levels, chemical and physical properties, operating methods, and industrial and regulatory limitations. Concurrently constant efforts must be made to evaluate the individual situation in terms of the total radiation exposures of the population and in terms of necessary economic considerations. Over the long term the growth of the nuclear industry, medical uses, and military applications, when compared with current health standards, easily justify an alert attitude on the part of industry and governmental agencies. With the growth, research and development should continue to provide practical and more economical solutions to specific potential hazards, if waste handling, treatment, disposal, and evaluation are given sufficient priority by industry and government. (auth)

13044

SOIL ADSORPTION OF RADIOACTIVE WASTES AT LOS ALAMOS. C. W. Christenson, Eric B. Fowler, George L. Johnson, Elgin H. Rex, and Felix A. Virgil (Los Alamos Scientific Lab., N. Mex.). Sewage and Ind. Wastes **30**, 1478-89(1958) Dec.

Cylindrical samples of the Tshirege member of the Bandelier tuff were tested for adsorption of radioactive nuclides from waste solutions containing Pu-239 , Cs-137 , or Sr-90 , as well as mixtures of these. In addition, observations on leaching were made. Cs-137 and Pu-239 were readily retained by the tuff; however, the Pu-239 can be released by a subsequent discharge of solutions such as versene. Sr-90 was not retained by the tuff nearly as well as the other nuclides tested and was more easily released. (J.R.D.)

REACTORS

General

13045 AE-13

Aktiebolaget Atomenergi, Stockholm.

ABSORPTION AND FLUX DENSITY MEASUREMENTS IN AN IRON PLUG IN R1. Ragnar Nilsson and Josef Braun. Aug. 1958. 26p.

Thermal, epithermal, and fast neutron fluxes were measured in a 60 cm long, "sliced" iron plug, which was placed in the lower iron lid of the Swedish Reactor R-1. Au foils, Cu foils, Mn foils, P packets, Cu wires and small Fe cylinders were used. The gamma flux was determined with film dosimeters. The measurements show that only in the first centimeters of the iron is the activation determined by the thermal flux, which decreases with a relaxation length $\lambda = (1.51 \pm 0.02) \text{ cm}$. The epithermal flux is entirely predominant already after 10 cm ($\lambda = 16 \text{ cm}$). The epithermal neutron flux decreases even more slowly than the fast flux ($\lambda = 6.2 \text{ cm}$). (auth)

13046 AECD-4277

Massachusetts Inst. of Tech., Oak Ridge, Tenn.

Engineering Practice School.

LOOP-TYPE LIQUID-GAS SEPARATOR. J. W. Barlow,

F. H. Jones, and R. H. Reuther. Nov. 17, 1951. Decl. Apr. 17, 1959. 23p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-eng-26, Subcontract 70.] (KT-117). \$4.80(ph), \$2.70(mf) OTS.

In liquid-type homogeneous reactors, bubbles of gas are formed as a result of fissions and radiation. The loop separator consists essentially of a single coil of pipe or tubing inserted into the fuel stream. In passing through the loop, a mixture of gas and liquid will be acted upon by centrifugal forces which concentrate the gas on the inner surface of the loop. Extraction taps located on this inner surface permit removal of this gas layer. (W.L.H.)

13047 APAE-48

Alco Products, Inc., Schenectady, N. Y.
THEORY OF ASYMMETRIC ARRAYS OF CONTROL RODS IN NUCLEAR REACTORS. Raymond L. Murray. Apr. 25, 1959. 50p. Contract AT(30-3)-326. \$7.80 (ph), \$3.30 (mf) OTS.

A two-group diffusion theory was developed with as complete generality as possible. The method is as yet restricted to the unreflected core, or to the reflected core by use of reflector savings and bare equivalent geometries. The physical state of the system for which criticality conditions are sought is: (a) Cylindrical homogenized core of height H and radius R , where dimensions may be considered as extrapolated or bare equivalent. (b) Two-group diffusion theory (or modified two-group) for the behavior of fast and thermal neutrons. Physical boundary conditions on both groups are to be applied at rod surfaces. (c) The core is traversed through its full height by a total of $M + 1$ control "rods," the shapes of which are immaterial, so long as one may define extrapolation distances at surfaces of equivalent circular rods. One of these rods may be along the central axis, the remaining M may be located anywhere. (d) Every rod in the system may be different in its size, radius a_m , fast and thermal extrapolation distances d_{1m} and d_{2m} , where the subscript m refers to the m^{th} rod. (e) The radial and angular location of the center of each of the m rods may be designated as d_m , the distance from the central core axis, and β_m , an angle between any pre-determined reference core radial plane and the plane through the rod center. (auth)

13048 GEAP-2064

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

FINAL SUMMARY SAFEGUARDS REPORT FOR THE GENERAL ELECTRIC TEST REACTOR. R. K. Andersen and I. M. Jacobs. Feb. 20, 1958. 182p. \$28.80(ph), \$8.40(mf) OTS.

The maximum and minimum transient and steady state limits of operation for the reactor are set forth. Detailed discussions are presented on the site and environmental factors, the containment vessel and its design basis, the reactor description and performance data, proposed experimental facilities, reactor facility operating standards and procedures, and accident safeguards analysis and radiation hazards evaluation. (W.D.M.)

13049 IDO-16508

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

OPERATION OF THE MTR ON A PLUTONIUM LOADING. D. R. deBoisblanc and R. S. Marsden. Dec. 22, 1958. 28p. Contract AT(10-1)-205. \$1.00 (OTS).

In August of 1958 the MTR was successfully operated

on plutonium fuel for 262 megawatt days at powers up to a maximum of 30 megawatts. The power was scheduled at less than the maximum for the greater portion of the cycle because of inclusions which were suspected to contain Pu in higher than average density in the fuel alloy of several fuel elements. No difficulties were encountered that could be attributed to the core. The run was concluded with a sustained operation at 30 Mw for 34 MWD. With the modifications required by the small delayed neutron fraction of plutonium, the control system performance was satisfactory at all times. A number of reactor physics measurements preceded the operation at power. The results of some of these measurements and other important items are listed. (auth)

13050 IDO-16519

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

GAMMA HEAT GENERATION IN THE ETR. C. H. Hogg, L. D. Weber, and M. W. Echo. Apr. 14, 1959. 41p. Contract AT(10-1)-205. \$1.25(OTS).

The gamma heat generations in selected positions of the ETR were measured with aluminum calorimeters and graphite- CO_2 ion chambers. Midplane gamma heat generation maps are presented for two fuel loadings along with vertical traverses for selected positions. Descriptions of the measuring instruments are also included. (auth)

13051 HW-54991

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FLUIDIZATION STUDIES WITH STEEL BALLS AND WATER. V. P. Kelly. Apr. 29, 1958. 54p. Contract [W-31-109-Eng-52]. \$9.30(ph), \$3.60(mf) OTS.

Fluidization studies were made of steel ball in water to determine the parameters which influence solids dispersion and to correlate fluidization data pertinent to fluidized-bed reactor design. Beds of $\frac{3}{8}$ - and $\frac{3}{4}$ -in. balls were fluidized in 6- and 9-in. pipes with water from 13 to 52°C. Density fluctuations were measured by a gamma absorption technique. Five conclusions were made from the results: (1) Beds of solids can be fluidized without channeling or slugging, although dispersion may not be absolutely uniform. (2) Optimum uniformity is obtained with approximately equal bed-depth and bed-diameter and with conical flow distributors. (3) Fluid viscosity change has little or no effect on fluidization quality and fluid velocity-bed expansion relationships. (4) Knowledge of physical laws governing fluid beds is inadequate for the selection of optimum parameters for a fluid-bed reactor. (5) Gamma absorptiometry is practical for the study of density fluctuations. (D.E.B.)

13052 KAPL-M-LGB-13

Knolls Atomic Power Lab., Schenectady, N. Y.

APPLICATION OF PILE MODULATION MEASUREMENT TECHNIQUES. L. G. Barrett. May 22, 1957. Decl. April 10, 1959. 34p. Contract W-31-109-Eng-52. \$6.30(ph), \$3.00(mf) OTS.

Pile modulation techniques are presently being used to measure cross sections, power coefficients, fuel element temperature coefficients due to cyclic heating, and the ratio of prompt neutron generation time to effective delayed neutron fraction. These applications are discussed with emphasis placed on the need for pile oscillator power coefficient measurements in S3G. In addition, several other new applications are proposed and recommendations made concerning the practicality of

application to S3G. Of particular importance is a proposed pile modulation technique for locating ruptured fuel elements in a reactor. If proved feasible this technique could be applied to S3G as a backup system with practically no modification of the existing design. (auth)

13053 CEA-tr-A-511

UN RÉACTEUR DE RECHERCHE À BERLIN. (Berlin Research Reactor.) Translated from *Atomwirtschaft* 2, 232(1957). 6p.

The Berlin Research reactor will be a "water boiler" reactor with 50 kw heat production. The initial conception of a research reactor in Berlin and the realization of this concept are briefly reviewed. (J.S.R.)

13054 CEA-tr-A-512

LE RÉACTEUR EXPÉRIMENTAL DE HAMBOURG. (The Hamburg Experimental Reactor.) N. W. Junker-man. Translated into French by B. Moreau from *Atomwirtschaft* 2, 233-8(1957). 26p.

The Hamburg Research Reactor is a swimming pool reactor using 20% enriched uranium in aluminum-clad aluminum-uranium alloy as fuel. The experimental installations of the reactor and the coolant system are described in detail. The factors influencing the selection of a site for the reactor are discussed. The reactor characteristics are given. (J.S.R.)

13055 CEA-tr-A-541

LA FONCTION D'INFLUENCE DANS LA CINÉTIQUE DU RÉACTEUR. (The Influence Function (Importance Function) In Reactor Kinetics.) H. Grümmer (Grimm) and K. H. Hocker. Translated into French by R. Pfeiffer from *Z. angew. Phys.* 9, 305-13(1957). 26p.

The elementary equation of reactor kinetics is derived. The importance function is defined, and its equations are obtained. The reactor kinetic equations are then formulated with the importance function. The relationship between the flux equations and the importance equations are explained by a two-group diffusion process. (J.S.R.)

13056

REACTOR START-UP. *Acad. rep. populare Romîne, Inst. fiz. atomică și Inst. fiz. Studii cercetări fiz.* 9, 159-60(1958). (In Rumanian)

A brief description is given of the Rumanian swimming pool reactor. It is fueled with enriched uranium and develops a flux, at a power of 2000 kw, of 2×10^{13} n/cm²/sec. The reactor was designed for research and isotope production. (J.S.R.)

13057

FUEL ELEMENTS. A. G. Samoilov and V. S. Volkov. *Atomnaya Energ.* 6, 261-76(1959) Mar. (In Russian)

The preparation of fuel elements and their performance in various reactors are analyzed on the basis of data presented at the Second Geneva Conference. (tr-auth)

13058

THE ACCIDENT WITH THE ZERO POWER REACTOR ON OCTOBER 15, 1958. Pavle P. Savić. *Bull. Inst. Nuclear Sci. "Boris Kidrich"* (Belgrade) 9, 1-4(1959). (In French)

During a subcritical experiment with the zero power reactor, the reactor became uncontrolled and went supercritical. Six people within the immediate vicinity of the reactor received very high doses of neutron and ionizing radiation. Two additional people received smaller doses, which were, however, above the maxi-

mum permissible dose. One fatality resulted. The cause of the accident was investigated. During the experiments, the alarm system and the automatic shut-down apparatus were not functioning. The dosimetry control system and the automatic safety rod drop were constructed with no interlock system so that the reactor could be operated without these controls. The personnel detected the anomalous operation by the smell of ozone. The power increase was detected by a strong increase of the gamma radiation during a time interval of 10 minutes on recorders of atmospheric activity placed 540 m from the reactor in a direct line. The neutron and gamma dose received by the personnel was estimated from the activity of gold and copper objects on their person and the phosphorus activity of the urine. It was estimated that the average total neutron dose was 388 rem and the gamma dose was 295 rem giving a total average dose of 683 rem. (J.S.R.)

13059

ZERO ENERGY REACTOR "RB". D. Popović, S. Takač, H. Marković, N. Raišić, Z. Zdravković, and Lj. Radanović. *Bull. Inst. Nuclear Sci. "Boris Kidrich"* (Belgrade) 9, 5-13(1959).

In 1958 the zero energy reactor RB was built with the purpose of enabling critical experiments with various reactor systems to be carried out. The first core assembly built in the reactor consists of heavy water as moderator and natural uranium metal as fuel. In order to be able to obtain very accurate results when measuring the main characteristics of the assembly the reactor was built as a completely bare system. (auth)

13060

MEASUREMENT OF $M^3 [M^2]$ AND k_{∞} FOR A HEAVY WATER-NATURAL URANIUM ASSEMBLY. D. Popović, N. Raišić, H. Marković, S. Takač, Z. Zdravković, and B. Lolić. *Bull. Inst. Nuclear Sci. "Boris Kidrich"* (Belgrade) 9, 15-19(1959).

The migration length M and the infinite multiplication factor k_{∞} of the heavy water-natural uranium bare assembly are determined by measuring the reactivity of the reactor as function of the heavy water level. Since the assembly is nonreflected, the results obtained are of relatively high accuracy. (auth)

13061

MEASUREMENT OF SAFETY-ROD EFFECTIVENESS OF THE ZERO ENERGY REACTOR "RB". N. Raišić, D. Popović, S. Takač, H. Marković, R. Martinc, and Lj. Radanović. *Bull. Inst. Nuclear Sci. "Boris Kidrich"* (Belgrade) 9, 21-7(1959).

The reactivity effectiveness of the two safety rods displaced eccentrically along the diameter of a cylindrical D₂O moderated reactor was measured and compared with the theoretical calculations. The results show that the simplified calculations of one rod effectiveness are quite satisfactory but the theoretical evaluation of the interference effect of the two rods is not sufficiently reliable. (auth)

13062

STATISTICS OF NUCLEAR REACTORS OF THE WORLD. II. G. Gandusio. *Energia nucleare* (Milan) 6, 93-140(1959) Feb. (In Italian)

In the second part of the article the principal features of the reactors now under construction or at an advanced design stage are tabulated. (J.S.R.)

13063

DEVELOPMENT OF NUCLEAR ENERGY IN SWEDEN.

H. Brynielsson (AB Atomenergi, Stockholm). Energia nucleare (Milan) 6, 173-9(1959) Mar. (In Italian)

The pressing necessity of using nuclear energy for residential and industrial heating in Sweden is demonstrated. The functions, programs, and realizations of the governmental or commercial nuclear organizations of the country are reviewed with particular regard to Aktiebolaget Atomenergi (Atomic Energy Company). The private nuclear activities of Sweden are also briefly mentioned, and the close collaboration between Government and industries is underlined. (auth)

13064

REACTOR ACCIDENT DYNAMICS. Henri B. Smets (Brookhaven National Lab., Upton, N. Y.). Energie nucleare (Milan) 6, 192-206(1959) Mar.

The reactor kinetic equations are integrated by various methods in case of large reactivity variations at low and high power operation. At low power the effect of the delayed neutrons is small and a perturbation series can be used successfully. At high power two types of approximate solutions are proposed and compared, in a simple case, to the exact solution found by topological methods. The power burst of water cooled and moderated reactors are computed by means of the so-called logarithmic method and compared favorably to the experimental burst shape. (auth)

13065

MELUSINE: FIRST REACTOR OF THE GRENOBLE CENTRE D'ETUDES NUCLEAIRES. Bernard Fabre and Francois Rossillon (Centre d'Etudes Nucléaires, Grenoble, France). Inds. atomiques 3, No. 1-2, 42-9 (1959). (In French)

The Mélusine is a swimming pool reactor with a nominal power of 1.2 Mw and a maximum theoretical flux of 10^{13} thermal neutrons/cm²/sec. The reactor building, the pool, reactor core, experimental facilities, cooling, water purification, control and measurements, and the safety are briefly considered. (J.S.R.)

13066

EXPERIMENTS ON THE DYNAMIC BEHAVIOR OF HOMOGENEOUS REACTORS WITH AQUEOUS SOLUTION. Bernard R. Moskowitz (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Inds. atomiques 3, No. 1-2, 54-64(1959). (In French)

The results of a study on the dynamic behavior of a homogenous reactor of the water boiler type are indicated. The factors determining the dynamic behavior are the excess reactivity, the initial temperature, the initial pressure of the core, and the power. The conditions for transient experiments are given, and the results are briefly discussed. The method for the analysis of the data from transient experiments is given. It is shown that the power excursions are perfectly controlled by self-regulation and cause only low pressure variations in the core. (J.S.R.)

13067

ON THE EFFICIENCY OF A CONCENTRIC CUT-OFF ROD OF A THERMAL REACTOR AS A FUNCTION OF THE INSERTED LENGTH OF THE ROD. G. M. Schindler. J. Nuclear Energy 8, 18-32(1958). Nov.

The problem considered is that of determining the efficiency of a partially inserted control rod of a thermal reactor by calculating the buckling. Since, according to one-group theory, this buckling is the smallest eigenvalue of the differential equation for the thermal neutron flux with the corresponding boundary conditions,

it is derived from a classical variational problem. (auth)

13068

THERMAL STRESSES IN REACTOR SHELLS DUE TO γ -IRRADIATION. M. J. Hillier (Rolls Royce, Ltd., Derby, Eng.). J. Nuclear Energy 8, 33-47(1958) Nov.

Methods of calculating the temperatures and stresses in shells forming the pressure vessel or thermal shield of a nuclear reactor are given. It is assumed that the γ -ray currents are known on the inner surface of the shell. The heating and stress effects are considered, with particular reference to temperature boundary conditions and limitations of the flat slab approximation to the stresses in hollow cylinders and spheres. (auth)

13069

DIFFUSION COOLING OF NEUTRONS IN A FINITE SOLID MODERATOR ASSEMBLY. K. S. Singwi and L. S. Kothari (Atomic Energy Establishment, Bombay). J. Nuclear Energy 8, 59-62(1958) Nov.

An expression for the decay constant of the fundamental spatial mode of neutron flux as a function of the buckling of moderating assembly is derived, without making any explicit assumption regarding the variation of transport mean free path λ_{tr} with neutron energy. Numerical results are presented for beryllium, and it is shown that the relation between the diffusion cooling constant and the relaxation time of the last stages of slowing down is a very sensitive function of the variation of λ_{tr} with energy; as such it is not possible to estimate the relaxation time by a measurement of the diffusion cooling constant. (auth)

13070

ON CALCULATIONS FOR CYLINDRICAL REACTORS. V. K. Savilev. J. Nuclear Energy 8, 100-1(1958) Nov.

In Marchuk's method of reactor calculation the group constants are calculated by averaging cross sections over lethargy groups, and the group equations are solved by difference factorization. The possibility is discussed of using an approximate Laplacian enabling the entire procedure of the second stage of the method to be applied. (W.D.M.)

13071

LUBRICATION IN THE NUCLEAR AGE. C. G. Williams. Sci. Lubrication 10, 13-16(1958) Nov.

Lubrication of reactor components and effects of radiation on lubricants are discussed. (W.D.M.)

13072

NUCLEAR REACTOR CONTROL SYSTEMS. Siemens Rev. No. 25, 159-76(1958) Sept.

Instrumentation of power reactors, control of power station reactors, influence of the reference adjuster in the reactor control circuit on the accuracy and dynamics of the control system, and neutron flux measuring channels for nuclear reactors are considered. (TCO)

13073

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 12. REACTOR PHYSICS. Geneva, United Nations, 1958. 774p. \$18.50.

Papers from sessions B-17, B-18, and B-21 of the Geneva Conference on fast and intermediate reactors, liquid moderated reactors, and solid moderated reactors are presented. (W.D.M.)

13074**FUEL ELEMENTS FOR NUCLEAR REACTORS.**

Joseph Henry Handwerk, Robert Andrew Noland, and David Edward Walker. British Patent 809,280. Feb. 18, 1959.

A stable fuel material for swimming pool reactors is offered. Al and U_3O_8 are ball-milled and mixed and extruded at 485°C. If Mg replaces Al, the extrusion temperature should be 415°C. The extrusion may be done in an Mg or Al can for better corrosion resistance. Pickling in HNO_3 removes U-containing particles from the surface of the fuel element, thereby reducing radioactive fission products in the cooling water. Photomicrographs are included to show the superiority of the U_3O_8 -Al over conventional UO_2 -Al in which instability arises from UAl_4 formation. (T.R.H.)

13075**PROCESS FOR RECOVERING GASEOUS FISSION**

PRODUCTS FOR NUCLEAR REACTOR. (to Deutsche Gold- und Silber-Scheideanstalt Vormals Roessler). British Patent 809,586. Feb. 25, 1959.

It is proposed that fission product gases be continuously removed from reactors by sweeping with inert gases or the cooling gas of gas-cooled reactors. (T.R.H.)

13076**NUCLEAR REACTORS AND SUB-ASSEMBLY THERE-**

FOR. Joseph Edward Draley and Westly Ernest Ruther. British Patent 811,528. Apr. 8, 1959.

An Al-Fe-Ni alloy for fuel element cladding and coolant channel construction is described. Results of various corrosion tests are given to show that Ni improves the corrosion resistance of Al to hot water. Fe may be substituted for some of the Ni to improve the nuclear cross section of the alloy for use in a reactor. (T.R.H.)

13077

IMPROVEMENTS RELATING TO SAFETY SYSTEMS FOR NUCLEAR REACTORS. Anthony Edward Thomas Nye (to The British Thomson-Houston Co., Ltd.). British Patent 811,600. Apr. 8, 1959.

A relay system for shutting down a reactor in the event of an accident or failure is described. The system is so arranged that a power failure would not shut down the reactor. (T.R.H.)

13078

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Frank Butler and John Tatlock (to United Kingdom Atomic Energy Authority). British Patent 813,131. May 6, 1959.

A fast breeder reactor fuel assembly is described which should prevent bowing. The fuel tube, clad inside and out, is fitted with bands of spiral fins at a helix angle of 60 to 80°. For a fuel length of 21 in. there are four 2-in. bands with 6 fins each. (T.R.H.)

13079

IMPROVEMENTS RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Douglas Francis Welch and Peter Raymond Joseph French (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 813,132. May 6, 1959.

A fuel element design is offered which would make higher operating temperatures possible. The center of the element would consist of UC or UO_2 which do not undergo $\alpha \rightarrow \beta$ transition. The outside would be U metal; thus, a surface temperature up to the transition

temperature (650 to 660°C) is possible without loss of mechanical integrity. (T.R.H.)

Power**13080 ACNP-5909**

Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee.

PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT FOR JANUARY 1959-MARCH 1959. May 1, 1959. 98p. For Northern State Power Co. and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. \$16.80(ph), \$5.70(mf) OTS.

Property studies of various alloy materials for fuel element cladding are described. Attempts to plate UO_2 pellets with Zr were performed. Corrosion studies on aluminum alloys in acid and in corrosion loops are reported. Results from the superheater thermal resistance test are summarized. Mechanical design and fission gas release of the boiler fuel elements are discussed. By a series of approximations based on existing information, the liquid level contour in the reactor vessel was calculated. Four flat tensile specimens of 2 wt. % B-stainless steel were tested at 500 and 1000°F. Wetter variations of the reference core were investigated for total coefficients, power distributions, and control rod worths. The effect of variations in the moderator density was determined for the reference boiler core. Lattice constants were determined for the low enriched superheater element concept. Burnup characteristics of the two-region core were calculated. Concentrations of N^{14} in various parts of the turbine building were calculated. A small 50 in.² wound wire-metallic type filter was tested for filtration and backwashing characteristics. Calculations were performed to estimate the conditions and concentrations of the plant "off-gas" under normal full power operation. Work on instrumentation is summarized. (For preceding period see ACNP-5904.) (W.D.M.)

13081 AECD-4278

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

FREEZING OF ICE PLUGS IN PROCESS LINES OF THE HRT. A. B. Reynolds, J. R. Buchanan, Jr., R. E. Lueders, and W. A. Stewart. Apr. 23, 1954. Decl. Apr. 16, 1959. 43p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-eng-26, Sub-contract 70.] (KT-169). \$7.80(ph), \$3.30(mf) OTS.

Fuel in the Homogeneous Reactor Test (HRT) is to be a solution of $UO_2(NO_3)_2$ in heavy water. When maintenance of the reactor or an auxiliary is necessary, the tank containing the reactor and process lines will be filled with light water for the purpose of shielding. Some method must be devised to prevent light water from entering the system when equipment is removed for repairs. The method studied in this investigation was the freezing of ice plugs in the pipe lines before flanges are disconnected. (W.L.H.)

13082 AECU-4103

Duquesne Light Co., Shippingport, Penna.

REACTOR PLANT CONTAINER AIR COOLING SYSTEM. SECTION III. SECOND PERFORMANCE. Test Results DL-S-136 (T-550090). Second Issue, Mar. 25, 1959. 9p. \$1.80(ph), \$1.80(mf) OTS.

A study was made of the performance of the reactor plant air cooling system with four reactor coolant loops at operating temperatures. No significant conclusions

can be made concerning the efficiency of the air cooling system due to the fact that the test was performed with the chamber doors open. (J.E.D.)

13083 AECU-4104

Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "C" SURVEY. SECTION III—2790 EFPH. SECOND PERFORMANCE. Test Results DL-S184 (T-612076). First issue, Mar. 24, 1959. 10p. \$1.80(ph), \$1.80(mf) OTS.

A study was made of the rate of radioactive decay of the hairpin loops after isolation and changes in radiation level resulting from continued operation of the reactor at power. Results indicated that the radiation decayed very rapidly after isolation of the hairpin loop. (J.E.D.)

13084 AECU-4109

Sargent and Lundy, Chicago.
COST OF CONTAINMENT FEATURES FOR BOILING WATER REACTORS FOR ARGONNE NATIONAL LABORATORY, LEMONT, ILLINOIS. Job 1957-1. Oct. 15, 1957. 40p. (SL-1443). \$9.30(ph), \$3.60(mf) OTS.

An analysis of the cost of containment features for nuclear power plants utilizing boiling water reactors was made. The two plants chosen for comparison were the EBWR at ANL and a hypothetical large-scale nuclear power plant with an electrical capacity of 180 Mw. In order that a cost analysis could be made for the plant designs, general arrangement drawings were prepared for each of the alternate arrangements considered. (W.D.M.)

13085 AECU-4114

Duquesne Light Co., Shippingport, Penna.
CONTROL ROD POSITIONS FOR CRITICALITY. SECTION II. THIRD PERFORMANCE. Test Results DL-S-149 (T-550130). First Issue Mar. 24, 1959. 20p. \$3.30(ph), \$2.40(mf) OTS.

Critical bank heights and bank worths for various rod configurations at normal plant operating temperature and pressure are determined. (J.E.D.)

13086 APAE-Memo-159

Alco Products, Inc., Schenectady, N. Y.
MATERIAL SPECIFICATIONS FOR APPR-1 CORE II CONTROL ROD FUEL ELEMENTS AND ABSORBER SECTIONS. E. C. Edgar and R. D. Robertson. Dec. 30, 1958. 11p. Contract AT(30-3)-278. \$1.80(ph), \$1.80(mf) OTS.

The control rod fuel elements consist of 16 flat composite fuel plates joined to a pair of side plates to form an integral assembly with a nominal water gap spacing of 0.133 inches between fuel plates. The core section of the fuel plate contains an active fuel section and a flux suppressor section. The fuel section is composed of UO_2 , B_4C , and type 304LB stainless steel. The suppressor section is composed of Eu_2O_3 and elemental stainless steel powder. The absorber section of the assembly contains four absorber plates. The core section of the absorber plate is cermet, composed of Eu_2O_3 dispersed in stainless steel. (W.L.H.)

13087 BAW-1019(Suppl. 1)

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT (PHASE 1C). Supplement to LMFRE Reference Design Report, December 1957. [nd]. 36p. Contract AT(30-1)-1140. \$1.25(OTS).

The Section of Chemical Processing Systems pre-

pared jointly by Babcock and Wilcox Co. and [Oak Ridge National Lab.].

A number of modifications to the LMFRE preliminary reference design is described. These modifications include engineering design changes to achieve economics in the original reference design and a revised cost estimate that reapportions the various construction, research and development, and operating costs. Since the Phase 1 and Phase 1C reference designs have many features in common, only differences between the two plant designs are noted. Features common to both plants are given in BAW-1019. (W.D.M.)

13088 GEAP-0971

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
FREQUENCY RESPONSE OF WEIGHTED VOIDS vs. POWER. J. J. Hogle. Feb. 21, 1957. 32p. \$6.30(ph), \$3.00(mf) OTS.

A method for calculating the frequency response of weighted voids (proportional to reactivity of steam voids) as a function of reactor power is presented. (auth)

13089 GEAP-2009

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.
POWER DISTRIBUTION IN BOILING REACTORS. John W. Weil. July 25, 1957. 24p. (VAL-23). \$4.80(ph), \$2.70(mf) OTS.

It is found that the presence of steam voids in the core of a large boiling reactor causes distortions of the power distribution which are of engineering significance. The calculation of these distortions and methods for their regulation are discussed in detail. A consequence of these distortions is that the functions of engineering and nuclear design are much more tightly coupled than is the case for other reactor types. (W.D.M.)

13090 LA-2303

Los Alamos Scientific Lab., N. Mex.
A PRELIMINARY STUDY OF THE TURRET EXPERIMENT—AN OPERATING TEST OF UNCLAD FUEL AT HIGH TEMPERATURE. R. P. Hammond and J. P. Cody, eds. Mar. 1959. 90p. Contract W-7405-eng-36. \$2.25(OTS).

A preliminary study has been made of an impregnated graphite reactor to produce helium at 2400°F for process heat uses. The proposed facility will determine the characteristics and problems associated with operation of unclad graphite fuel. Volatile fission products will escape from the fuel elements into the helium stream, which will be continuously purified. Laboratory studies have shown that impregnated graphite will perform satisfactorily at the proposed conditions, and a simple fuel cycle has been developed. (auth)

13091 NAA-SR-Memo-2548

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ISOTOPIC CHANGES IN SGR FUEL. T. J. Connolly. Feb. 18, 1958. 7p. \$1.80(ph), \$1.80(mf) OTS.

The changes in isotope concentration in SGR fuel were calculated using effective cross section values somewhat modified from those in previous reports. The results are presented in a form intended to facilitate their use in various SGR projects. (W.D.M.)

13092 NNSD-NSPS-1003

Newport News Shipbuilding and Dry Dock Co., Va.
NUCLEAR SHIP PROPULSION STUDY. Interim Technical Report [No. 4 summarizing work for period

November 1, 1954 to July 1, 1955]. J. B. Woodward, III. July 1, 1955. Decl. April 9, 1959. 33p. \$6.30(ph), \$3.00(mf) OTS.

A study was made of pressurized water reactor fuel costs, and results of the study are tabulated. It was seen that the cost of U consumed is not the major element in the cost of nuclear fuel. A fuel cost study was also made for homogeneous reactors. Fuel costs appear slightly better than those of fuel oil in some cases, and are distinctly superior to those of pressurized water systems. Various machinery arrangements are under study, and diagrams of these arrangements are given. Results of a reactor plant weight study are also summarized. Engineering specifications for a merchant ship reactor plant are included in an appendix. (W.L.H.)

13093 NP-7475

Sharp (George G.) Inc., New York.

AN ANALYSIS OF SHIP COLLISIONS WITH REFERENCE TO PROTECTION OF NUCLEAR POWER PLANTS. V. U. Minorsky. 1958. 10p.

The extent of penetrations in ship collisions is considered. It is pointed out that collisions of nuclear powered ships, particularly in harbor channels or territorial waters, could result in serious radioactive contamination of the environment. From this standpoint it becomes necessary to predict the conditions under which the reactor space of a nuclear ship will remain intact, and what structural strength should be built into the hull for kinetic energy absorption. A method of solution is presented which follows a semi-analytical approach based on the facts of twenty-four actual collisions. Use of the method is explained. (J.R.D.)

13094 TID-7020 (Vol. I)

Duquesne Light Co., Shippingport, Penna.

SHIPPINGPORT ATOMIC POWER STATION MANUAL. VOLUME I. OPERATION GUIDE. [1958].

Revisions may be issued for the various chapters listed below. Chapter:

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13095 WAPD-CDA(I)-154

Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.

DETERMINATION OF THE EFFECTIVE NEUTRON FLUX FOR PRODUCTION OF TRITIUM FROM LIOH IN PRIMARY COOLANT OF PWR. P. W. Frank. Dec. 15, 1958. 5p. \$1.80(ph), \$1.80(mf) OTS.

The average neutron flux in PWR for the production of tritium was calculated to be $(1.72 \pm 0.24) \times 10^{12}$ n/cm²-sec (68.79 Mw gross electrical) from the specific activity of tritium in the primary coolant during the second 1000 hr run. The assigned uncertainty includes the standard error in fitting the data to the given equation and the standard error in the lithium analyses. This value for the flux is only 19% greater than the value calculated from plant parameters which is known to give low results. Therefore, it is believed that additional specific tests to determine this flux more accurately are not warranted. (auth)

13096 WAPD-PWR-PC-1406

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. REACTOR ROD CONTROL SYSTEM. Evaluation of Results of Test Procedure DL-S-127. N. E. Wilson. Aug. 1, 1958. 2p. Contract AT-11-1-GEN-14. \$1.80 (ph), \$1.80(mf) OTS.

The purpose of the period II test procedure was to determine that the reactor rod control system performed in accordance with design requirements. Test results on all four sections are reviewed and evaluated. (W.D.M.)

13097 WAPD-PWR-PC-1637

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PRIMARY PLANT CONTROL AND INSTRUMENTATION. SECTION I. Evaluation of Test Results for DL-S-125 (T-550079). N. E. Wilson. Dec. 5, 1958. 2p. Contract AT-11-1-GEN-14. \$1.80(ph), \$1.80(mf) OTS.

Results are given of tests to determine if the main coolant pump stator and bearing water temperature monitors and the primary coolant pump noise monitors operate properly. Several recommendations on the results are given and discussed. (W.D.M.)

13098 WAPD-PWR-TE-23

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. CORE INSTRUMENTATION CALIBRATION. PERIOD IV. Test Evaluation DL-S-162 (T-550128). William J. Gallagher. Aug. 20, 1958. 6p. \$1.80(ph), \$1.80(mf) OTS.

In determination of power distribution through PWR core 1, thermocouples are used at water inlets and exits and in seed elements. Test procedure for calibration of these thermocouples is given as well as test data and an evaluation of the data. (J.R.D.)

13099 WAPD-TH-458

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh. DEPARTURE FROM NUCLEATE BOILING DATA FOR 0.097 IN. \times 1 IN. \times 12.06 IN. FINNED RECTANGULAR CHANNEL TEST SECTION. R. Masnovi and J. S. Williams, Jr. Dec. 1958. 23p. \$4.80(ph), \$2.70(mf) OTS.

Tests were conducted on a standard 12.06 in. long rectangular channel test section that had 0.005 in. equilateral fins parallel to the direction of coolant flow on both sides of the water channel. The tests were performed with vertical upflow of water at 2000 psia at mass velocities from 0.37 to 1.13×10^6 lb/hr-ft² and inlet coolant temperatures of 300, 400, and 500°F. The results showed that these fins had no effect on the total heat transferred by the specimen at DNB when compared with a conventional 0.097 in. \times 1 in. \times 12.06 in. unfinned DNB specimen. Thus, the finned specimen DNB flux, when based on a projected heat transfer area, is equal to the DNB flux of a conventional test specimen. Appendix I contains a discussion of fin theory as applied to the reduction of film temperature drop in the forced convection (heating) region of heat transfer. This discussion shows that reactor design improvement by the use of fins depends upon the design criteria (constant flow, constant pressure drop, or constant pumping power) and the relative magnitudes of the local coolant film drop and coolant enthalpy rise from channel inlet to the channel position considered. The Appendix also contains a discussion of fin theory as applied to operation in the nucleate boiling region near DNB. This analysis shows that because of the small differences in wall temperature between an unfinned specimen and a theoretical finned specimen the test results do not confirm, nor deny, the validity of fin theory at flux conditions approaching DNB. (auth)

13100 YAE-75

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MODEL STUDY OF THE PRESSURE DROP RELATIONSHIPS IN A TYPICAL FUEL ROD ASSEMBLY. R. T. Berringer and A. A. Bishop. Feb. 1959. 31p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. \$6.30(ph), \$3.00(mf) OTS.

A study was made of hydraulic characteristics of

Yankee-type fuel rod assemblies using experimental and analytical methods. Two scale model fuel assemblies utilizing both ferrule and strap type arrangements were constructed and tested at atmospheric pressure and room temperature. Analytical methods using semi-empirical relationships are substantiated by experimental results for both the fuel assembly having strap-type spacers and the fuel assembly having cylindrical ferrule-type spacers. The experimental pressure drop across the assembly model using either straps or ferrules correlated within 5% of the value calculated by means of equations based on the equivalent diameter concept for flow inside pipes. The individual frictional drops along the rods and across the end plates and straps correlated within 15% of the predicted pressure drops. The individual pressure drops across both the staggered ferrule sections and the full ferrule section correlated to within 17% of the predicted pressure drops. Comparison of the ferrule and the strap pressure drops indicates that the pressure drop across a level of straps was more than four times the pressure drop across a full ferruled section. It is concluded that the analytical methods based on the equivalent diameter concept can be satisfactorily used to calculate pressure drops for flow parallel to fuel rod bundles. Experimental tests on this fuel rod configuration with either straps or ferrules indicated no excessive energy losses due to vortex formations. (auth)

13101 YAE-80

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

THERMAL DEFLECTION OF THE YANKEE FUEL ASSEMBLY FROM LINEAR AND NON-LINEAR TEMPERATURE GRADIENTS. Carl G. Johnson. Mar. 1959. 68p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. \$12.30(ph), \$4.50(mf) OTS.

Theoretical conditions were investigated for determining the thermal deflection of the definitive design unshrouded Yankee fuel assembly and the compromise design fuel assembly. In addition, an experimental study was completed on the thermal deflection of the compromise design fuel assembly from linear and non-linear temperature gradients. All of the theoretical analyses performed on the definitive design clearly indicate that excessive bowing in the order of 0.150 inch may occur within the reactor during normal operation. Since the nominal clearance available in this design between a fuel assembly and an adjacent control rod is about 0.120 inch, interference between a fuel assembly and its adjacent control rod can occur, resulting in restricting the movement of the control rod. When buildup of mechanical tolerances are considered, this condition becomes more severe. Redesign of the definitive design fuel assembly thus became mandatory to prevent interference with the movement of control rods. The compromise fuel assembly design evolved as a result of these considerations. The compromise design employs the use of the brazed ferrule fuel sub-assembly design concept, but incorporates several fundamental changes in design that increase clearances adjacent to the control rod to reduce thermal bowing of the complete assembly. The compromise fuel assembly is allowed to deflect under thermal distortion to a limited extent and is designed so that under the worst set of circumstances the available clearance between the fuel assembly and control rod is at least 0.001 inch. The compromise design therefore, constitutes a safe design from a thermal deflection standpoint. (auth)

13102 YAEC-123

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MONTHLY PROGRESS REPORT FOR THE PERIOD MARCH 1 TO 31, 1959. H. E. Walchli. Apr. 20, 1959. 14p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. \$3.30(ph), \$2.40(mf) OTS.

Work toward developing a satisfactory stainless steel clad UO_2 fuel was continued. Studies and calculations of the reactor core, criticality experiments, irradiation experiments, shielding, and the reactor start-up and operation are reported. Studies directed toward establishing methods of utilizing chemical poisoning for reactor control and the crud and corrosion problems in the reference environment are reported. (For preceding period see YAEC-121.) (W.L.H.)

13103 CEA-tr-R-610

CYCLE THERMIQUE DANS LES CENTRALES NUCLÉAIRES. (Thermal Cycle in Nuclear Power Stations.) D. P. Gokhshtein. Translated into French by B. Vinogradoff from *Atomnaya Energ. Prirozhenie* 1, 199-205(1958). 12p.

This paper was previously abstracted from the original language and appears in *NSA*, Vol. 12, as abstract No. 15901.

13104 CEA-tr-R-614

AVENIR DE L'ÉNERGÉTIQUE NUCLÉAIRE EN UNION SOVIÉTIQUE. (Future of Nuclear Energy in the Soviet Union.) V. S. Emelyanov (Emelianov). Translated into French from *Atomnaya Energ.* 5, 217-22(1958). 18p.

This paper was previously abstracted from the original language and appears in *NSA*, Vol. 13, as abstract No. 3424.

13105

POWER PLANT REACTORS. G. F. Kohlmayr.

Atompraxis 5, 66-73(1959) Feb. (In German)

From the point of view of nuclear reaction a picture is drawn of the common problems of power plant reactors and their development. After a listing of the criteria for classifying reactors, there is a discussion of the basic physical, technological, and economic problems involved in twelve different reactor types: pressurized water reactor, boiling water reactor, sodium-graphite reactor, aqueous-homogenous reactor, fast breeder reactor, gas-cooled graphite reactor, liquid-metal breeder reactor, D_2O reactor, organic-moderated reactor, ceramic-fuel reactor, molten-plutonium reactor, and suspension reactor. (auth)

13106

SUMMARY REPORT OF THE INTERNATIONAL PANEL. PROJECT ENSI (ENERGIA NUCLEARE SUD ITALIA). Washington, D. C., International Bank for Reconstruction and Development, 1959. 27p. Available from World Bank, Washington, D. C.

In July 1957, the Government of Italy and the International Bank for Reconstruction and Development agreed to sponsor a joint study on possibilities of a large nuclear power station in Southern Italy. The joint study, known as project ENSI, included the selection of a site for a nuclear plant, the preparation of invitations to qualified manufacturers, a review of tenders submitted and the preparation of an evaluated judgement on them, and the development of cost information for a conventional power plant operating under the conditions and load envisaged for the proposed nuclear plant. Nine tenders were received. The working

Group of Project ENSI examined all tenders, prepared an estimate of the civil works cost of each, and made a technical tabulation of each proposal. The technical aspects of the tenders were reviewed by groups at the U.K. AEA and at Argonne National Laboratory. Reports were in turn reviewed by the International Panel, which began work in Rome on July 1, 1958. Technical features and cost aspects of each proposal are summarized. (C.H.)

13107

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Siemens-Schuckertwerke Aktiengesellschaft Co.). British Patent 810,718. Mar. 18, 1959.

A two-zone pressurized water reactor is described. The fuel elements are suspended in tubes in zone I where water is heated up and escapes from the tops of the fuel assemblies through steam valves. The steam let into zone II by the steam valves is cycled through turbines and back as liquid to the region around the fuel channels in zone II thereby cooling them. Condensate in zone I is recycled to zone II as feed water. (T.R.H.)

13108

IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Alan Robert Kirkpatrick (to C. A. Parsons & Co., Ltd.). British Patent 811,405. Apr. 2, 1959.

A graphite reactor loading system is described. Each loading channel through the outer shell of the reactor serves 37 fuel channels by means of a movable loading pipe inside the concrete shell. (T.R.H.)

13109

IMPROVEMENTS IN OR RELATING TO HEAT TRANSFER ARRANGEMENTS. Donald Arthur Boyland (to General Electric Co., Ltd.). British Patent 811,597. Apr. 8, 1959.

A method of arranging the fuel elements in the channels of a gas-cooled reactor is offered. The axes of the fuel rods are not parallel to the axis of the channel. Both transverse or longitudinal fins may be used on the fuel rods to promote turbulence and improve heat transfer. (T.R.H.)

13110

IMPROVEMENTS IN AND RELATING TO NUCLEAR PLANT. William Macrae (to C. A. Parsons & Co., Ltd.). British Patent 811,856. Apr. 15, 1959.

A control system for nuclear power plants with a reactor which has a closed primary coolant circuit is described. A thermostat-operated primary-coolant pump would keep primary coolant temperature constant. The secondary coolant system with high- and low-pressure steam generators is equipped to operate at constant pressure regardless of turbine load. A pressure-sensitive switch at the steam generator output operates the reactor control rods. (T.R.H.)

13111

IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Robert Allen Kline and William Macrae (to C. A. Parsons & Co., Ltd.). British Patent 812,004. Apr. 15, 1959.

A piping arrangement is shown and discussed which permits selection of the coolant channel to be tested for ruptured elements within the concrete shield. Thus the numerous outlets through the shield, one for each coolant channel, for sampling coolant for radioactivity are avoided. Further, the selection is done stepwise in that a group of channels is selected, and then a particular channel in that group is singled out for monitoring. (T.R.H.)

13112

IMPROVEMENTS IN OR RELATING TO METHOD OF IRRADIATING SUBSTANCES BY NEUTRONS. Cyril Reid. British Patent 812,681. Apr. 29, 1959.

A thorium breeder element design is described. The Th compound, $\text{Th}(\text{CO}_3)_2$, calcined at 200°C is compressed in a barrel-shaped mold to a density of 3.3 in canisters of Al, Mg, or Be, and the canisters are then put in a tube. The canisters expand slightly in the tube giving good thermal contact. The canister length should be between 1.0 and 0.3 times the diameter. This arrangement allows easy removal and caustic dissolution of canister from tube, thus facilitating recovery of the U^{233} produced during irradiation. (T.R.H.)

STABLE ISOTOPE SEPARATION

13113

SEPARATION OF THE HEAVY ISOTOPES OF C, S, Kr, AND Ne BY DIFFUSION IN A CURRENT OF VAPOR. I. G. Gverdtsiteli and V. K. Tshhakaya. *Atomnaya Energ.* 6, 329-30(1959) Mar. (In Russian)

Sulfur isotopes (using SO_2), carbon isotopes (using CH_4), and krypton isotopes were separated at 12 mm Hg pressure with equilibration times not exceeding 15 hours. Practically all the cascade was used for enrichment. A special evaporation condenser system regulated the cascade current and pressure. The separation coefficients obtained for various mixtures were: $\text{S}^{34}\text{O}_4 - \text{S}^{32}\text{O}_2$, 1.036; $\text{S}^{36}\text{O}_2 - \text{S}^{32}\text{O}_2$, 1.057; $\text{C}^{13}\text{H}_4 - \text{C}^{12}\text{H}_4$, 1.095; $\text{Kr}^{86} - \text{Kr}^{84}$, 1.033; $\text{Ne}^{22} - \text{Ne}^{20}$, 1.16 to 1.2. The specific separation efficiency of the cascade installation was about two times higher than the efficiency of previously described similar installations. (R.V.J.)

13114

SEPARATION FACTORS FOR BORON ISOTOPE EXCHANGE. BORON TRIFLUORIDE COMPLEXES WITH TETRAHYDROFURAN AND TRIETHYLAMINE. S. V. Ribnikar and G. A. Bootsma. *Bull. Inst. Nuclear Sci. "Boris Kidrich"* (Belgrade) 9, 91-4(1959).

Separation factors for boron isotope exchange between boron trifluoride and its complexes with tetrahydrofuran and triethylamine were measured. The obtained values of $(\alpha)M = 0$ are 1.036 ± 0.002 (at 25°C) and 1.023 ± 0.001 (at 30°C) respectively. In conducting boron trifluoride gas through a medium containing diphenyl ether with a well developed surface area, adsorption effects were only observed. (auth)

13115

NOTE ON THE FEASIBILITY OF THE BORON FLUORIDE MONOHYDRATE PROCESS OF BORON ISOTOPE SEPARATION. Slobodan V. Ribnikar and Živojin V. Knežević. *Bull. Inst. Nuclear Sci. "Boris Kidrich"* (Belgrade) 9, 111-13(1959).

The boron isotope separation process, based on the exchange between boron trifluoride and boron trifluoride monohydrate, contains a chemical reflux reaction. Sulfur trioxide is used to convert the monohydrate to boron trifluoride gas. A method is given for limiting

the great solubility of boron trifluoride in the sulfuric acid. By this method a reflux ratio of 325 is attainable, sufficient for the production of boron-10 with 99% isotopic purity. (A.C.)

TECHNOLOGY

Feed Materials

13116 MCW-1427

Mallinckrodt Chemical Works, St. Charles, Mo. IONIUM RECOVERY PLANT DESIGN REPORT. R. M. Edwards, R. H. Fariss, and R. G. Werkema. Apr. 15, 1959. 105p. Contract W-14-108-eng-8. \$2.50(OTS).

The recovery of thorium by solvent extraction was studied in pilot plant pulse columns, using a filtered liquor from nitric acid digestion of the raffinate cake produced by the ethyl ether extraction of uranium from pitchblende. On the basis of the data obtained, plant facilities have been designed for the production of a thorium concentrate containing 5000 grams of ionium (thorium-230). Such a plant is estimated to cost \$3,137,500. Operating costs are estimated at \$51.47 per gram of ionium, not including credit for recovered uranium (2.7 pounds per gram of ionium). (auth)

13117 WIN-95

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

THE DEHYDRATION OF GREEN SALT, UF_4 .

A. Whitman and R. W. Lindstrom. May 1, 1959. 40p. Contract AT(49-6)-924. \$6.30(ph), \$3.00(mf) OTS.

Several methods were investigated for the dehydration of green salt produced by precipitation from aqueous solution. As a result of this investigation a procedure was devised in which metal-grade salt was produced by dehydration in a tube furnace at 400 to 500°C . Using this method, no special furnace atmosphere is required. An air flush is used to provide the proper oxidation after most of the moisture is removed from the salt. (auth)

Raw Materials

13118

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 3. PROCESSING OF RAW MATERIALS. Geneva, United Nations, 1958. 615p. \$15.00.

The papers in the first section of this volume discuss mining aspects and instrumentation including instrumentation for prospecting, mining, and assaying and application of mathematical methods to mining problems. The second section discusses ore treatment and analytical methods including beneficiation, general development and plant description, acid leaching, alkaline leaching, ion exchange, solvent extraction, uranium determination, thorium determination, and beryllium determination. (W.L.H.)

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